

## SEQUENZPROTOKOLL

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&lt;110&gt; Bayer Aktiengesellschaft

<120> Nucleinsäuren, die für Enzymaktivitäten der  
Spinosa-Biosynthese codieren

&lt;130&gt; Le A 33 955

&lt;140&gt;

&lt;141&gt;

&lt;150&gt; DE 199 40 596.4

&lt;151&gt; 1999-08-27

&lt;150&gt; DE 199 57 268.2

&lt;151&gt; 1999-11-29

&lt;160&gt; 55

&lt;170&gt; PatentIn Ver. 2.1

&lt;210&gt; 1

&lt;211&gt; 50000

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 1

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 245 250 255

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 Glu Lys Tyr Ala His Asp Met Gly Tyr Ala Ile Leu Thr Ala Arg Lys  
 260 265 270

ccg gtc ggc tga 828  
 Pro Val Gly  
 275

<210> 8

<211> 275

<212> PRT

<213> *Saccharopolyspora spinosa*

<400> 8

Val Leu Pro Gly Gly Ala Pro Thr Ser Gln Gln Val Gly Gln Met Tyr  
 1 5 10 15

Asp Leu Val Thr Pro Leu Leu Asn Ser Val Ala Gly Gly Pro Cys Ala  
 20 25 30

Ile His His Gly Tyr Trp Glu Asn Asp Gly Arg Ala Ser Trp Gln Gln  
 35 40 45

Ala Ala Asp Arg Leu Thr Asp Leu Val Ala Glu Arg Thr Val Leu Asp  
 50 55 60

Gly Gly Val Arg Leu Leu Asp Val Gly Cys Gly Thr Gly Gln Pro Ala  
 65 70 75 80

Leu Arg Val Ala Arg Asp Asn Ala Ile Gln Ile Thr Gly Ile Thr Val  
 85 90 95

Ser Gln Val Gln Val Ala Ile Ala Ala Asp Cys Ala Arg Glu Arg Gly  
 100 105 110

Leu Ser His Arg Val Asp Phe Ser Cys Val Asp Ala Met Ser Leu Pro  
 115 120 125

Tyr Pro Asp Asn Ala Phe Asp Ala Ala Trp Ala Met Gln Ser Leu Leu  
 130 135 140

Glu Met Ser Glu Pro Asp Arg Ala Ile Arg Glu Ile Leu Arg Val Leu  
 145 150 155 160

Lys Pro Gly Gly Ile Leu Gly Val Thr Glu Val Val Lys Arg Glu Ala  
 165 170 175

Gly Gly Gly Met Pro Val Ser Gly Asp Arg Trp Pro Thr Gly Leu Arg  
 180 185 190

Ile Cys Leu Ala Glu Gln Leu Leu Glu Ser Leu Arg Ala Ala Gly Phe  
 195 200 205

Glu Ile Leu Asp Trp Glu Asp Val Ser Ser Arg Thr Arg Tyr Phe Met  
 210 215 220

Pro Gln Phe Ala Glu Glu Leu Ala Ala His Gln His Gly Ile Ala Asp  
 225 230 235 240

Arg Tyr Gly Pro Ala Val Ala Gly Trp Ala Ala Ala Val Cys Asp Tyr  
 245 250 255

Glu Lys Tyr Ala His Asp Met Gly Tyr Ala Ile Leu Thr Ala Arg Lys  
 260 265 270

Pro Val Gly  
 275

<210> 9

<211> 1173

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1)..(1170)

<223> ORF2; Glycosyltransferase

<400> 9

atg cgc gta ctc gtc gtt ccc ttg ccc tat ccg acg cat ctc atg gca 48  
 Met Arg Val Leu Val Val Pro Leu Pro Tyr Pro Thr His Leu Met Ala  
 1 5 10 15

atg gtg ccg ctg tgc tgg gcg ctg caa gca tcc ggg cac gag gtc ctg 96  
 Met Val Pro Leu Cys Trp Ala Leu Gln Ala Ser Gly His Glu Val Leu  
 20 25 30



atc gcc gca cca cca gag ctg cag gcg acc gcg cat ggt gca ggt ctc	144
Ile Ala Ala Pro Pro Glu Leu Gln Ala Thr Ala His Gly Ala Gly Leu	
35 40 45	
acc acg gcc ggg atc cgc ggg aac gac agg acc ggc gat acg ggt gga	192
Thr Thr Ala Gly Ile Arg Gly Asn Asp Arg Thr Gly Asp Thr Gly Gly	
50 55 60	
acc acg cag ctg cgc ttt ccc aat ccg gcg ttc ggt cag cgc gac acc	240
Thr Thr Gln Leu Arg Phe Pro Asn Pro Ala Phe Gly Gln Arg Asp Thr	
65 70 75 80	
gag gca ggc cgg caa ctg tgg gag cag acc gcg tcc aat gtc gcg caa	288
Glu Ala Gly Arg Gln Leu Trp Glu Gln Thr Ala Ser Asn Val Ala Gln	
85 90 95	
agc tcg ctc gat cag ctc ccc gaa tac ctt cga ctg gcc gag gcc tgg	336
Ser Ser Leu Asp Gln Leu Pro Glu Tyr Leu Arg Leu Ala Glu Ala Trp	
100 105 110	
cga ccg tca gtg ctg ttg gtc gac gtc tgc gcg ctg atc ggc cgg gtg	384
Arg Pro Ser Val Leu Leu Val Asp Val Cys Ala Leu Ile Gly Arg Val	
115 120 125	
ctc ggc gga ttg ctc gac ctg ccg gtc gtg ctg cac cgc tgg gga gtc	432
Leu Gly Gly Leu Leu Asp Leu Pro Val Val Leu His Arg Trp Gly Val	
130 135 140	
gac ccc acc gca ggc ccc ttc agc gat cga gcc cac gag ttg ctt gac	480
Asp Pro Thr Ala Gly Pro Phe Ser Asp Arg Ala His Glu Leu Leu Asp	
145 150 155 160	
ccg gtg tgc cgg cac cac gga ctg acc ggc ctg ccc act ccc gag ctc	528
Pro Val Cys Arg His His Gly Leu Thr Gly Leu Pro Thr Pro Glu Leu	
165 170 175	
atc ctc gat ccc tgt ccg ccg agc ctg caa gca agc gac gcg ccg caa	576
Ile Leu Asp Pro Cys Pro Pro Ser Leu Gln Ala Ser Asp Ala Pro Gln	
180 185 190	
ggc gca ccg gtc cag tac gtg ccg tac aac gga agc ggc gca ttc ccg	624
Gly Ala Pro Val Gln Tyr Val Pro Tyr Asn Gly Ser Gly Ala Phe Pro	
195 200 205	
gca tgg ggc gcg gcg cgc acc tca gca cgg cgg gtc tgc atc tgc atg	672
Ala Trp Gly Ala Ala Arg Thr Ser Ala Arg Arg Val Cys Ile Cys Met	
210 215 220	

ggc cgc atg gtg ctg aac gcc acc ggg ccg gct ccg ctg ctg cgc gca	720
Gly Arg Met Val Leu Asn Ala Thr Gly Pro Ala Pro Leu Leu Arg Ala	
225 230 235 240	
gta gcg gct gcc acc gag ttg ccc ggc gtc gag gcc gtg atc gcc gtt	768
Val Ala Ala Ala Thr Glu Leu Pro Gly Val Glu Ala Val Ile Ala Val	
245 250 255	
ccc ccc gag cac cgg gca ctt ctc acc gac cta ccc gac aac gcc cgg	816
Pro Pro Glu His Arg Ala Leu Leu Thr Asp Leu Pro Asp Asn Ala Arg	
260 265 270	
atc gcc gaa tcg gtc ccg ctc aac ctg ttc ctg cgt acc tgc gag ctg	864
Ile Ala Glu Ser Val Pro Leu Asn Leu Phe Leu Arg Thr Cys Glu Leu	
275 280 285	
gtc atc tgc gcg ggc ggc tcg gga acg gca ttc acc gcg acc cga ctc	912
Val Ile Cys Ala Gly Gly Ser Gly Thr Ala Phe Thr Ala Thr Arg Leu	
290 295 300	
ggc atc ccg caa ctc gtg ctt ccc cag tac ttc gac cag ttc gac tac	960
Gly Ile Pro Gln Leu Val Leu Pro Gln Tyr Phe Asp Gln Phe Asp Tyr	
305 310 315 320	
gcg cgc aac ctc gcc gct gcc ggg gcg ggc atc tgc ttg ccg gat gag	1008
Ala Arg Asn Leu Ala Ala Ala Gly Ala Gly Ile Cys Leu Pro Asp Glu	
325 330 335	
cag gcc cag tcc gac cac gaa cag ttc acc gac tca atc gca acg gtg	1056
Gln Ala Gln Ser Asp His Glu Gln Phe Thr Asp Ser Ile Ala Thr Val	
340 345 350	
ctc ggc gac acc ggc ttc gct gct gcg gca atc aaa ctc agc gac gag	1104
Leu Gly Asp Thr Gly Phe Ala Ala Ala Ala Ile Lys Leu Ser Asp Glu	
355 360 365	
atc acg gcc atg ccc cat ccc gcc gcg ctg gtg cgg acg ctg gag aac	1152
Ile Thr Ala Met Pro His Pro Ala Ala Leu Val Arg Thr Leu Glu Asn	
370 375 380	
act gcg gcc atc cgt gcc tga	1173
Thr Ala Ala Ile Arg Ala	
385 390	

<210> 10

<211> 390

&lt;212&gt; PRT

<213> *Saccharopolyspora spinosa*

&lt;400&gt; 10

Met Arg Val Leu Val Val Pro Leu Pro Tyr Pro Thr His Leu Met Ala

1 5 10 15

Met Val Pro Leu Cys Trp Ala Leu Gln Ala Ser Gly His Glu Val Leu

20 25 30

Ile Ala Ala Pro Pro Glu Leu Gln Ala Thr Ala His Gly Ala Gly Leu

35 40 45

Thr Thr Ala Gly Ile Arg Gly Asn Asp Arg Thr Gly Asp Thr Gly Gly

50 55 60

Thr Thr Gln Leu Arg Phe Pro Asn Pro Ala Phe Gly Gln Arg Asp Thr

65 70 75 80

Glu Ala Gly Arg Gln Leu Trp Glu Gln Thr Ala Ser Asn Val Ala Gln

85 90 95

Ser Ser Leu Asp Gln Leu Pro Glu Tyr Leu Arg Leu Ala Glu Ala Trp

100 105 110

Arg Pro Ser Val Leu Leu Val Asp Val Cys Ala Leu Ile Gly Arg Val

115 120 125

Leu Gly Gly Leu Leu Asp Leu Pro Val Val Leu His Arg Trp Gly Val

130 135 140

Asp Pro Thr Ala Gly Pro Phe Ser Asp Arg Ala His Glu Leu Leu Asp

145 150 155 160

Pro Val Cys Arg His His Gly Leu Thr Gly Leu Pro Thr Pro Glu Leu

165 170 175

Ile Leu Asp Pro Cys Pro Pro Ser Leu Gln Ala Ser Asp Ala Pro Gln

180 185 190

Gly Ala Pro Val Gln Tyr Val Pro Tyr Asn Gly Ser Gly Ala Phe Pro

195 200 205

Ala Trp Gly Ala Ala Arg Thr Ser Ala Arg Arg Val Cys Ile Cys Met

210 215 220

Gly Arg Met Val Leu Asn Ala Thr Gly Pro Ala Pro Leu Leu Arg Ala

225 230 235 240

Val Ala Ala Ala Thr Glu Leu Pro Gly Val Glu Ala Val Ile Ala Val  
 245 250 255

Pro Pro Glu His Arg Ala Leu Leu Thr Asp Leu Pro Asp Asn Ala Arg  
 260 265 270

Ile Ala Glu Ser Val Pro Leu Asn Leu Phe Leu Arg Thr Cys Glu Leu  
 275 280 285

Val Ile Cys Ala Gly Gly Ser Gly Thr Ala Phe Thr Ala Thr Arg Leu  
 290 295 300

Gly Ile Pro Gln Leu Val Leu Pro Gln Tyr Phe Asp Gln Phe Asp Tyr  
 305 310 315 320

Ala Arg Asn Leu Ala Ala Ala Gly Ala Gly Ile Cys Leu Pro Asp Glu  
 325 330 335

Gln Ala Gln Ser Asp His Glu Gln Phe Thr Asp Ser Ile Ala Thr Val  
 340 345 350

Leu Gly Asp Thr Gly Phe Ala Ala Ala Ile Lys Leu Ser Asp Glu  
 355 360 365

Ile Thr Ala Met Pro His Pro Ala Ala Leu Val Arg Thr Leu Glu Asn  
 370 375 380

Thr Ala Ala Ile Arg Ala  
 385 390

<210> 11

<211> 753

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1)..(750)

<223> ORF3; O-Methyltransferase

<400> 11

atg ccc tcc cag aac gcg ctg tac ctg gac ctg ctc aag aag gta ctc 48  
 Met Pro Ser Gln Asn Ala Leu Tyr Leu Asp Leu Leu Lys Lys Val Leu  
 1 5 10 15

acc aac acg att tac agt gat cgg ccg cat ccg aac gcc tgg cag gac	96
Thr Asn Thr Ile Tyr Ser Asp Arg Pro His Pro Asn Ala Trp Gln Asp	
20 25 30	
aac acc gac tac agg cag gcc gct cgg gcc aaa ggc acg gac tgg cca	144
Asn Thr Asp Tyr Arg Gln Ala Ala Arg Ala Lys Gly Thr Asp Trp Pro	
35 40 45	
act gtc gcg cac acg atg atc ggt ctg gag cgg ctg gac aac ctc cag	192
Thr Val Ala His Thr Met Ile Gly Leu Glu Arg Leu Asp Asn Leu Gln	
50 55 60	
cac tgc gtg gaa gcc gtg ctc gca gac ggt gtt ccc ggg gat ttc gcc	240
His Cys Val Glu Ala Val Leu Ala Asp Gly Val Pro Gly Asp Phe Ala	
65 70 75 80	
gag acc ggt gtc tgg cgg ggc ggc gca tgc atc ttc atg cgc gcg gtt	288
Glu Thr Gly Val Trp Arg Gly Gly Ala Cys Ile Phe Met Arg Ala Val	
85 90 95	
ctc cag gca ttc gga gat acc gga cgt acc gtc tgg gta gtg gat tcc	336
Leu Gln Ala Phe Gly Asp Thr Gly Arg Thr Val Trp Val Val Asp Ser	
100 105 110	
ttc cag gga atg ccg gaa agc tct gcg caa gac cac caa gcg gac cag	384
Phe Gln Gly Met Pro Glu Ser Ser Ala Gln Asp His Gln Ala Asp Gln	
115 120 125	
gct atg gcg ctg cac gag tac aac gac gtg ctt ggc gta tcg ctt gag	432
Ala Met Ala Leu His Glu Tyr Asn Asp Val Leu Gly Val Ser Leu Glu	
130 135 140	
acc gtc cgg cag aac ttc gcc cgc tac ggg ctg ctc gac gaa cag gtc	480
Thr Val Arg Gln Asn Phe Ala Arg Tyr Gly Leu Leu Asp Glu Gln Val	
145 150 155 160	
agg ttc ctc ccc ggc tgg ttc cgg gac acc ttg ccc acc gcc ccc atc	528
Arg Phe Leu Pro Gly Trp Phe Arg Asp Thr Leu Pro Thr Ala Pro Ile	
165 170 175	
cag gaa ctc gcc gtg cta cga ctc gac ggc gac ctc tac gaa tcc aca	576
Gln Glu Leu Ala Val Leu Arg Leu Asp Gly Asp Leu Tyr Glu Ser Thr	
180 185 190	
atg gac tca ttg cgg aac ctg tac ccg aag ctc tcg ccg ggc gga ttc	624
Met Asp Ser Leu Arg Asn Leu Tyr Pro Lys Leu Ser Pro Gly Gly Phe	
195 200 205	

gtc atc atc gac gac tat ttt ctg ccg tcc tgc cag gac gcg gtg aag 672  
 Val Ile Ile Asp Asp Tyr Phe Leu Pro Ser Cys Gln Asp Ala Val Lys  
 210 215 220

ggg ttc cgc gcg gaa ctc ggg atc acg gaa ccc atc cac gac atc gac 720  
 Gly Phe Arg Ala Glu Leu Gly Ile Thr Glu Pro Ile His Asp Ile Asp  
 225 230 235 240

ggc acg ggc gcc tac tgg cgc cgc agc tgg tga 753  
 Gly Thr Gly Ala Tyr Trp Arg Arg Ser Trp  
 245 250

<210> 12

<211> 250

<212> PRT

<213> Saccharopolyspora spinosa

<400> 12

Met Pro Ser Gln Asn Ala Leu Tyr Leu Asp Leu Leu Lys Lys Val Leu  
 1 5 10 15

Thr Asn Thr Ile Tyr Ser Asp Arg Pro His Pro Asn Ala Trp Gln Asp  
 20 25 30

Asn Thr Asp Tyr Arg Gln Ala Ala Arg Ala Lys Gly Thr Asp Trp Pro  
 35 40 45

Thr Val Ala His Thr Met Ile Gly Leu Glu Arg Leu Asp Asn Leu Gln  
 50 55 60

His Cys Val Glu Ala Val Leu Ala Asp Gly Val Pro Gly Asp Phe Ala  
 65 70 75 80

Glu Thr Gly Val Trp Arg Gly Gly Ala Cys Ile Phe Met Arg Ala Val  
 85 90 95

Leu Gln Ala Phe Gly Asp Thr Gly Arg Thr Val Trp Val Val Asp Ser  
 100 105 110

Phe Gln Gly Met Pro Glu Ser Ser Ala Gln Asp His Gln Ala Asp Gln  
 115 120 125

Ala Met Ala Leu His Glu Tyr Asn Asp Val Leu Gly Val Ser Leu Glu  
 130 135 140

Thr Val Arg Gln Asn Phe Ala Arg Tyr Gly Leu Leu Asp Glu Gln Val  
 145 150 155 160

Arg Phe Leu Pro Gly Trp Phe Arg Asp Thr Leu Pro Thr Ala Pro Ile  
 165 170 175

Gln Glu Leu Ala Val Leu Arg Leu Asp Gly Asp Leu Tyr Glu Ser Thr  
 180 185 190

Met Asp Ser Leu Arg Asn Leu Tyr Pro Lys Leu Ser Pro Gly Gly Phe  
 195 200 205

Val Ile Ile Asp Asp Tyr Phe Leu Pro Ser Cys Gln Asp Ala Val Lys  
 210 215 220

Gly Phe Arg Ala Glu Leu Gly Ile Thr Glu Pro Ile His Asp Ile Asp  
 225 230 235 240

Gly Thr Gly Ala Tyr Trp Arg Arg Ser Trp  
 245 250

<210> 13

<211> 1188

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1) .. (1185)

<223> ORF4; O-Methyltransferase

<400> 13

atg agt gag atc gca gtt gcc ccc tgg tcg gtg gtg gag cgt ttg ctg 48  
 Met Ser Glu Ile Ala Val Ala Pro Trp Ser Val Val Glu Arg Leu Leu  
 1 5 10 15

ctc gcg gcg ggt gcg ggc ccg gcg aag ctc cag gaa gca gtg cag gtg 96  
 Leu Ala Ala Gly Ala Gly Pro Ala Lys Leu Gln Glu Ala Val Gln Val  
 20 25 30

gcc gga ctg gac gcg gtg gcc gac gcc atc gtc gac gaa ctc gtc gta 144  
 Ala Gly Leu Asp Ala Val Ala Asp Ala Ile Val Asp Glu Leu Val Val  
 35 40 45

cgc tgc gat ccg ctg tcg ttg gac gag tcg gtg cga atc ggc ctg gag 192  
 Arg Cys Asp Pro Leu Ser Leu Asp Glu Ser Val Arg Ile Gly Leu Glu  
 50 55 60

atc act tct ggc gct cag ctg gtc cgg aga acc gtt gag ctc gat cac	240
Ile Thr Ser Gly Ala Gln Leu Val Arg Arg Thr Val Glu Leu Asp His	
65 70 75 80	
gca ggc ctg cgg ctc gcg gcg gtc gcc gaa gca gct gct gtt ctc cgg	288
Ala Gly Leu Arg Leu Ala Ala Val Ala Glu Ala Ala Ala Val Leu Arg	
85 90 95	
ttc gac gcg gtg gat ctg ctg gaa ggg ctc ttc ggc ccg gtt gac ggc	336
Phe Asp Ala Val Asp Leu Leu Glu Gly Leu Phe Gly Pro Val Asp Gly	
100 105 110	
agg cgg cac aac agc cgt gaa gtc cgc tgg tcg gac agc atg acg cag	384
Arg Arg His Asn Ser Arg Glu Val Arg Trp Ser Asp Ser Met Thr Gln	
115 120 125	
ttc tcg ccc gac cag ggc ctc gcc ggc gcg cag cgc ctg ctg gcg ttc	432
Phe Ser Pro Asp Gln Gly Leu Ala Gly Ala Gln Arg Leu Leu Ala Phe	
130 135 140	
cgg aac agg gtg tcc acc gcg gtg cac gcc gtg ctg gcc gca gcc gcc	480
Arg Asn Arg Val Ser Thr Ala Val His Ala Val Leu Ala Ala Ala Ala	
145 150 155 160	
acc agg cgc gcg gac ctc ggt gcg ctg gca gtc cgc tac gga tcc gac	528
Thr Arg Arg Ala Asp Leu Gly Ala Leu Ala Val Arg Tyr Gly Ser Asp	
165 170 175	
aaa tgg gcg gac ctg cac tgg tac acc gaa cac tac gag cac cac ttc	576
Lys Trp Ala Asp Leu His Trp Tyr Thr Glu His Tyr Glu His His Phe	
180 185 190	
tcc cga ttc cag gat gcc ccg gtg cga gtg ttg gaa ata gga atc ggt	624
Ser Arg Phe Gln Asp Ala Pro Val Arg Val Leu Glu Ile Gly Ile Gly	
195 200 205	
ggt tat cac gca ccc gaa ctc ggt ggt gct tcg ctg cgc atg tgg cag	672
Gly Tyr His Ala Pro Glu Leu Gly Gly Ala Ser Leu Arg Met Trp Gln	
210 215 220	
cgg tac ttc cgg cga ggt ctc gtt tac ggg ctg gac att ttc gag aaa	720
Arg Tyr Phe Arg Arg Gly Leu Val Tyr Gly Leu Asp Ile Phe Glu Lys	
225 230 235 240	
gcc ggg aac gaa ggg cac cga gtg cga aag ctg cga ggt gac cag agc	768
Ala Gly Asn Glu Gly His Arg Val Arg Lys Leu Arg Gly Asp Gln Ser	
245 250 255	



WO 01/16303

gat gcg gaa ttc ctg gaa gac atg gcg ggg aag atc ggg ccg ttc gac 816  
 Asp Ala Glu Phe Leu Glu Asp Met Ala Gly Lys Ile Gly Pro Phe Asp  
 260 265 270

att gtc atc gac gac ggc agc cat gtc aac gac cac gtc aag aaa tcc 864  
 Ile Val Ile Asp Asp Gly Ser His Val Asn Asp His Val Lys Lys Ser  
 275 280 285

ttc caa tcc ctg ttt ccg cac gtc cgc cca ggt ggt ttg tac gtc atc 912  
 Phe Gln Ser Leu Phe Pro His Val Arg Pro Gly Gly Leu Tyr Val Ile  
 290 295 300

gag gat ctc cag acg gcg tac tgg ccc ggc tac ggc ggt cgc gat ggg 960  
 Glu Asp Leu Gln Thr Ala Tyr Trp Pro Gly Tyr Gly Gly Arg Asp Gly  
 305 310 315 320

gaa ccc gcg gcc cag cgc acc tcg atc gac atg ctc aaa gaa ctg atc 1008  
 Glu Pro Ala Ala Gln Arg Thr Ser Ile Asp Met Leu Lys Glu Leu Ile  
 325 330 335

gac ggc ctg cat tat cag gag cgc gaa tcg cgg tgc ggg acc gag ccc 1056  
 Asp Gly Leu His Tyr Gln Glu Arg Glu Ser Arg Cys Gly Thr Glu Pro  
 340 345 350

tcc tac acg gaa cgg aac gtg gcg gcc ctg cac ttc tac cac aac ctg 1104  
 Ser Tyr Thr Glu Arg Asn Val Ala Ala Leu His Phe Tyr His Asn Leu  
 355 360 365

gta ttc gtg gag aaa ggg ctc aac gct gag cct gcc gcg ccg ggg ttc 1152  
 Val Phe Val Glu Lys Gly Leu Asn Ala Glu Pro Ala Ala Pro Gly Phe  
 370 375 380

gtg ccc cgg caa gcg ctc ggc gtc gag gac ggc tga 1188  
 Val Pro Arg Gln Ala Leu Gly Val Glu Asp Gly  
 385 390 395

&lt;210&gt; 14

&lt;211&gt; 395

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 14

Met Ser Glu Ile Ala Val Ala Pro Trp Ser Val Val Glu Arg Leu Leu  
 1 5 10 15

Leu Ala Ala Gly Ala Gly Pro Ala Lys Leu Gln Glu Ala Val Gln Val  
 20 25 30

Ala Gly Leu Asp Ala Val Ala Asp Ala Ile Val Asp Glu Leu Val Val  
 35 40 45

Arg Cys Asp Pro Leu Ser Leu Asp Glu Ser Val Arg Ile Gly Leu Glu  
 50 55 60

Ile Thr Ser Gly Ala Gln Leu Val Arg Arg Thr Val Glu Leu Asp His  
 65 70 75 80

Ala Gly Leu Arg Leu Ala Ala Val Ala Glu Ala Ala Ala Val Leu Arg  
 85 90 95

Phe Asp Ala Val Asp Leu Leu Glu Gly Leu Phe Gly Pro Val Asp Gly  
 100 105 110

Arg Arg His Asn Ser Arg Glu Val Arg Trp Ser Asp Ser Met Thr Gln  
 115 120 125

Phe Ser Pro Asp Gln Gly Leu Ala Gly Ala Gln Arg Leu Leu Ala Phe  
 130 135 140

Arg Asn Arg Val Ser Thr Ala Val His Ala Val Leu Ala Ala Ala Ala  
 145 150 155 160

Thr Arg Arg Ala Asp Leu Gly Ala Leu Ala Val Arg Tyr Gly Ser Asp  
 165 170 175

Lys Trp Ala Asp Leu His Trp Tyr Thr Glu His Tyr Glu His His Phe  
 180 185 190

Ser Arg Phe Gln Asp Ala Pro Val Arg Val Leu Glu Ile Gly Ile Gly  
 195 200 205

Gly Tyr His Ala Pro Glu Leu Gly Gly Ala Ser Leu Arg Met Trp Gln  
 210 215 220

Arg Tyr Phe Arg Arg Gly Leu Val Tyr Gly Leu Asp Ile Phe Glu Lys  
 225 230 235 240

Ala Gly Asn Glu Gly His Arg Val Arg Lys Leu Arg Gly Asp Gln Ser  
 245 250 255

Asp Ala Glu Phe Leu Glu Asp Met Ala Gly Lys Ile Gly Pro Phe Asp  
 260 265 270

Ile Val Ile Asp Asp Gly Ser His Val Asn Asp His Val Lys Lys Ser  
 275 280 285

Phe Gln Ser Leu Phe Pro His Val Arg Pro Gly Gly Leu Tyr Val Ile  
 290 295 300  
 Glu Asp Leu Gln Thr Ala Tyr Trp Pro Gly Tyr Gly Gly Arg Asp Gly  
 305 310 315 320  
 Glu Pro Ala Ala Gln Arg Thr Ser Ile Asp Met Leu Lys Glu Leu Ile  
 325 330 335  
 Asp Gly Leu His Tyr Gln Glu Arg Glu Ser Arg Cys Gly Thr Glu Pro  
 340 345 350  
 Ser Tyr Thr Glu Arg Asn Val Ala Ala Leu His Phe Tyr His Asn Leu  
 355 360 365  
 Val Phe Val Glu Lys Gly Leu Asn Ala Glu Pro Ala Ala Pro Gly Phe  
 370 375 380  
 Val Pro Arg Gln Ala Leu Gly Val Glu Asp Gly  
 385 390 395

&lt;210&gt; 15

&lt;211&gt; 1620

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(1617)

&lt;223&gt; ORF5; C-C verknüpfendes Enzym, Cyclisierungsenzym

&lt;400&gt; 15

atg atc tcg gct gcg ggc gaa caa agt gga cca gtc aga aaa gga ggg 48  
 Met Ile Ser Ala Ala Gly Glu Gln Ser Gly Pro Val Arg Lys Gly Gly  
 1 5 10 15  
 gcg gtg ccc gaa ttc cat gac ccg gca ccc atg aat cgt cga acc cca 96  
 Ala Val Pro Glu Phe His Asp Pro Ala Pro Met Asn Arg Arg Thr Pro  
 20 25 30  
 gga aca gag atc acc gtc gag ccc gac gat cct cgt tat ccg gac ctc 144  
 Gly Thr Glu Ile Thr Val Glu Pro Asp Asp Pro Arg Tyr Pro Asp Leu  
 35 40 45  
 gtc gtc ggg cac aac ccc cgt ttc acc gga aaa ccc gaa cgc atc cac 192

Val Val Gly His Asn Pro Arg Phe Thr Gly Lys Pro Glu Arg Ile His	
50 55 60	
atc gcc agc tcc gcc gaa gac gtc gtg cac gcc gtc gcc gac gcc gtg	240
Ile Ala Ser Ser Ala Glu Asp Val Val His Ala Val Ala Asp Ala Val	
65 70 75 80	
cgc acc ggc agg cgg gta ggg gtc cgc agc ggc ggg cac tgc ttc gag	288
Arg Thr Gly Arg Arg Val Gly Val Arg Ser Gly Gly His Cys Phe Glu	
85 90 95	
aat ctc gtt gcg gac ccg gcg atc cga gtg ctc gtc gac ctc tcc gag	336
Asn Leu Val Ala Asp Pro Ala Ile Arg Val Leu Val Asp Leu Ser Glu	
100 105 110	
ctc aac cgc gtg tac tac gac agc acg cgc ggg gca ttc gcg atc gag	384
Leu Asn Arg Val Tyr Tyr Asp Ser Thr Arg Gly Ala Phe Ala Ile Glu	
115 120 125	
gcg ggc gcc gcc ctc ggg cag gtg tac cga acc ctg ttc aag aac tgg	432
Ala Gly Ala Ala Leu Gly Gln Val Tyr Arg Thr Leu Phe Lys Asn Trp	
130 135 140	
ggc gtg acg atc ccg acc ggc gca tgt ccc ggg gtg ggc gca ggc ggg	480
Gly Val Thr Ile Pro Thr Gly Ala Cys Pro Gly Val Gly Ala Gly Gly	
145 150 155 160	
cac atc ctc ggc ggg gga tac ggc ccg ctg tcg cgc cga ttc ggt tcg	528
His Ile Leu Gly Gly Gly Tyr Gly Pro Leu Ser Arg Arg Phe Gly Ser	
165 170 175	
gtc gtc gac tac ctt caa ggc gtc gag gtc gtc gtg gtc gac cag gcc	576
Val Val Asp Tyr Leu Gln Gly Val Glu Val Val Val Val Asp Gln Ala	
180 185 190	
ggt gaa gtg cac atc gtc gag gcc gac cgg aac tcc acg ggc gcc ggt	624
Gly Glu Val His Ile Val Glu Ala Asp Arg Asn Ser Thr Gly Ala Gly	
195 200 205	
cac gac ttg tgg tgg gcg cac acc ggt ggc ggt ggc ggc aac ttc ggg	672
His Asp Leu Trp Trp Ala His Thr Gly Gly Gly Gly Gly Asn Phe Gly	
210 215 220	
atc gtc acc agg ttt tgg ctc cga acg ccg gac gtg gtc agc acc gac	720
Ile Val Thr Arg Phe Trp Leu Arg Thr Pro Asp Val Val Ser Thr Asp	
225 230 235 240	
gcc gca gag ctc ctg cca cgg ccg ccc gcg aca gtg ctg ctc cga tcg	768

Ala Ala Glu Leu Leu Pro Arg Pro Pro Ala Thr Val Leu Leu Arg Ser	
245 250 255	
ttc cac tgg ccg tgg cac gaa ctg aca gag cag tca ttc gcc gtg ctc	816
Phe His Trp Pro Trp His Glu Leu Thr Glu Gln Ser Phe Ala Val Leu	
260 265 270	
cta cag aac ttc ggc aat tgg tac gag cag cac agc gcg cct gaa tcc	864
Leu Gln Asn Phe Gly Asn Trp Tyr Glu Gln His Ser Ala Pro Glu Ser	
275 280 285	
acg caa ctc ggg ttg ttc agc acg ctc gtc tgc gca cac cgg caa gct	912
Thr Gln Leu Gly Leu Phe Ser Thr Leu Val Cys Ala His Arg Gln Ala	
290 295 300	
ggc tac gtc acg ctg aac gtt cac ctg gac ggc acg gat ccg aac gcg	960
Gly Tyr Val Thr Leu Asn Val His Leu Asp Gly Thr Asp Pro Asn Ala	
305 310 315 320	
gaa cgc acc ctg gcc gaa cac ctg tcg gcg atc aac gcc cag gtc ggc	1008
Glu Arg Thr Leu Ala Glu His Leu Ser Ala Ile Asn Ala Gln Val Gly	
325 330 335	
gtg act cca gcc gaa ggg ctg cgg gaa acc ctg ccg tgg ttg cga tcg	1056
Val Thr Pro Ala Glu Gly Leu Arg Glu Thr Leu Pro Trp Leu Arg Ser	
340 345 350	
acc cag gtg gcc ggg gcg atc gcc gaa ggc ggc gaa ccg ggc atg caa	1104
Thr Gln Val Ala Gly Ala Ile Ala Glu Gly Gly Glu Pro Gly Met Gln	
355 360 365	
cgg acc aag gtc aaa gcc gcc tac ttg cgc acc ggg ctg tcc gaa gct	1152
Arg Thr Lys Val Lys Ala Ala Tyr Leu Arg Thr Gly Leu Ser Glu Ala	
370 375 380	
caa cta gcc acg gtt tac cgg cgg ctg acc gtc tac gga tac gac aac	1200
Gln Leu Ala Thr Val Tyr Arg Arg Leu Thr Val Tyr Gly Tyr Asp Asn	
385 390 395 400	
cct gcg gcg gcg ctg ttg ctg ctc ggt tac ggc ggt atg gcg aat gcc	1248
Pro Ala Ala Ala Leu Leu Leu Leu Gly Tyr Gly Gly Met Ala Asn Ala	
405 410 415	
gtg gct ccg tcg gcc acc gca ctc gct cag cgc gac tcg gtt ctc aaa	1296
Val Ala Pro Ser Ala Thr Ala Leu Ala Gln Arg Asp Ser Val Leu Lys	
420 425 430	
gcg ctg ttc gtc acg aac tgg tcg gag ccc gcc gag gac gag cgg cat	1344

Ala Leu Phe Val Thr Asn Trp Ser Glu Pro Ala Glu Asp Glu Arg His  
 435 440 445

ctg acc tgg att cgc ggt ttc tac cgc gag atg tac gcc gaa acc ggc 1392  
 Leu Thr Trp Ile Arg Gly Phe Tyr Arg Glu Met Tyr Ala Glu Thr Gly  
 450 455 460

gga gtt ccg gtg cca ggt acc cgt gtc gac ggc tcc tac atc aac tac 1440  
 Gly Val Pro Val Pro Gly Thr Arg Val Asp Gly Ser Tyr Ile Asn Tyr  
 465 470 475 480

ccg gac acc gac ttg gcc gat cca ttg tgg aac acc tcc ggt gtt gcc 1488  
 Pro Asp Thr Asp Leu Ala Asp Pro Leu Trp Asn Thr Ser Gly Val Ala  
 485 490 495

tgg cac gac ctg tac tac aaa gac aac tac ccg cgg ctg cag cgg gcc 1536  
 Trp His Asp Leu Tyr Tyr Lys Asp Asn Tyr Pro Arg Leu Gln Arg Ala  
 500 505 510

aaa gcg cgg tgg gat ccg cag aac atc ttc cag cac ggc ctg tcg atc 1584  
 Lys Ala Arg Trp Asp Pro Gln Asn Ile Phe Gln His Gly Leu Ser Ile  
 515 520 525

aaa ccg ccg gca cgg ctt tca ccc ggt cag cca tga 1620  
 Lys Pro Pro Ala Arg Leu Ser Pro Gly Gln Pro  
 530 535

<210> 16  
 <211> 539  
 <212> PRT  
 <213> Saccharopolyspora spinosa

<400> 16  
 Met Ile Ser Ala Ala Gly Glu Gln Ser Gly Pro Val Arg Lys Gly Gly  
 1 5 10 15

Ala Val Pro Glu Phe His Asp Pro Ala Pro Met Asn Arg Arg Thr Pro  
 20 25 30

Gly Thr Glu Ile Thr Val Glu Pro Asp Asp Pro Arg Tyr Pro Asp Leu  
 35 40 45

Val Val Gly His Asn Pro Arg Phe Thr Gly Lys Pro Glu Arg Ile His  
 50 55 60

Ile Ala Ser Ser Ala Glu Asp Val Val His Ala Val Ala Asp Ala Val  
 65 70 75 80

Arg Thr Gly Arg Arg Val Gly Val Arg Ser Gly Gly His Cys Phe Glu  
                             85                            90                            95

Asn Leu Val Ala Asp Pro Ala Ile Arg Val Leu Val Asp Leu Ser Glu  
                             100                            105                            110

Leu Asn Arg Val Tyr Tyr Asp Ser Thr Arg Gly Ala Phe Ala Ile Glu  
                             115                            120                            125

Ala Gly Ala Ala Leu Gly Gln Val Tyr Arg Thr Leu Phe Lys Asn Trp  
                             130                            135                            140

Gly Val Thr Ile Pro Thr Gly Ala Cys Pro Gly Val Gly Ala Gly Gly  
                             145                            150                            155                            160

His Ile Leu Gly Gly Gly Tyr Gly Pro Leu Ser Arg Arg Phe Gly Ser  
                             165                            170                            175

Val Val Asp Tyr Leu Gln Gly Val Glu Val Val Val Val Asp Gln Ala  
                             180                            185                            190

Gly Glu Val His Ile Val Glu Ala Asp Arg Asn Ser Thr Gly Ala Gly  
                             195                            200                            205

His Asp Leu Trp Trp Ala His Thr Gly Gly Gly Gly Gly Asn Phe Gly  
                             210                            215                            220

Ile Val Thr Arg Phe Trp Leu Arg Thr Pro Asp Val Val Ser Thr Asp  
                             225                            230                            235                            240

Ala Ala Glu Leu Leu Pro Arg Pro Pro Ala Thr Val Leu Leu Arg Ser  
                             245                            250                            255

Phe His Trp Pro Trp His Glu Leu Thr Glu Gln Ser Phe Ala Val Leu  
                             260                            265                            270

Leu Gln Asn Phe Gly Asn Trp Tyr Glu Gln His Ser Ala Pro Glu Ser  
                             275                            280                            285

Thr Gln Leu Gly Leu Phe Ser Thr Leu Val Cys Ala His Arg Gln Ala  
                             290                            295                            300

Gly Tyr Val Thr Leu Asn Val His Leu Asp Gly Thr Asp Pro Asn Ala  
                             305                            310                            315                            320

Glu Arg Thr Leu Ala Glu His Leu Ser Ala Ile Asn Ala Gln Val Gly  
                             325                            330                            335

Val Thr Pro Ala Glu Gly Leu Arg Glu Thr Leu Pro Trp Leu Arg Ser  
 340 345 350  
 Thr Gln Val Ala Gly Ala Ile Ala Glu Gly Gly Glu Pro Gly Met Gln  
 355 360 365  
 Arg Thr Lys Val Lys Ala Ala Tyr Leu Arg Thr Gly Leu Ser Glu Ala  
 370 375 380  
 Gln Leu Ala Thr Val Tyr Arg Arg Leu Thr Val Tyr Gly Tyr Asp Asn  
 385 390 395 400  
 Pro Ala Ala Ala Leu Leu Leu Leu Gly Tyr Gly Gly Met Ala Asn Ala  
 405 410 415  
 Val Ala Pro Ser Ala Thr Ala Leu Ala Gln Arg Asp Ser Val Leu Lys  
 420 425 430  
 Ala Leu Phe Val Thr Asn Trp Ser Glu Pro Ala Glu Asp Glu Arg His  
 435 440 445  
 Leu Thr Trp Ile Arg Gly Phe Tyr Arg Glu Met Tyr Ala Glu Thr Gly  
 450 455 460  
 Gly Val Pro Val Pro Gly Thr Arg Val Asp Gly Ser Tyr Ile Asn Tyr  
 465 470 475 480  
 Pro Asp Thr Asp Leu Ala Asp Pro Leu Trp Asn Thr Ser Gly Val Ala  
 485 490 495  
 Trp His Asp Leu Tyr Tyr Lys Asp Asn Tyr Pro Arg Leu Gln Arg Ala  
 500 505 510  
 Lys Ala Arg Trp Asp Pro Gln Asn Ile Phe Gln His Gly Leu Ser Ile  
 515 520 525  
 Lys Pro Pro Ala Arg Leu Ser Pro Gly Gln Pro  
 530 535

&lt;210&gt; 17

&lt;211&gt; 1194

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;220&gt;



&lt;221&gt; CDS

&lt;222&gt; (1)..(1191)

&lt;223&gt; ORF6; Methyltransferase

&lt;400&gt; 17

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atg tcc aca acg cac gag atc gaa acc gtg gaa cgc atc atc ctc gcc 48
Met Ser Thr Thr His Glu Ile Glu Thr Val Glu Arg Ile Ile Leu Ala
  1             5             10             15

gcc gga tcc agt gcg gcg agc ctg gcc gac ctg acc acc gaa ctc gga 96
Ala Gly Ser Ser Ala Ala Ser Leu Ala Asp Leu Thr Thr Glu Leu Gly
      20             25             30

ctc gcc agg atc gca ccc gtg ctg atc gac gag atc ctc ttc cgc gcg 144
Leu Ala Arg Ile Ala Pro Val Leu Ile Asp Glu Ile Leu Phe Arg Ala
      35             40             45

gaa ccg gcc ccc gac atc gaa cgg acc gag gtc gcg gtc cag atc acc 192
Glu Pro Ala Pro Asp Ile Glu Arg Thr Glu Val Ala Val Gln Ile Thr
      50             55             60

cac cga ggc gag acc gtt gac ttc gtc ctg acg cta cag tcc ggt gag 240
His Arg Gly Glu Thr Val Asp Phe Val Leu Thr Leu Gln Ser Gly Glu
      65             70             75             80

ctg atc aag gcc gag caa cga ccg gtc gga gac gtc ccg ctg cgg atc 288
Leu Ile Lys Ala Glu Gln Arg Pro Val Gly Asp Val Pro Leu Arg Ile
      85             90             95

ggt tac gag ctc acc gat ctc atc gcc gag ttg ttc ggc cca gga gct 336
Gly Tyr Glu Leu Thr Asp Leu Ile Ala Glu Leu Phe Gly Pro Gly Ala
      100            105            110

ccc agg gcc gtc ggc gcc cgg agc acc aac ttc ctc cga acc acc aca 384
Pro Arg Ala Val Gly Ala Arg Ser Thr Asn Phe Leu Arg Thr Thr Thr
      115            120            125

tcc ggt tcg ata ccc ggt ccg tcg gaa ctg tcc gat ggc ttc cag gcc 432
Ser Gly Ser Ile Pro Gly Pro Ser Glu Leu Ser Asp Gly Phe Gln Ala
      130            135            140

atc tcc gca gtg gtc gcc ggc tgc ggg cac cga cgt ccc gac ctc aac 480
Ile Ser Ala Val Val Ala Gly Cys Gly His Arg Arg Pro Asp Leu Asn
      145            150            155            160

ttg ctc gcc tcc cac tac cgc acg gac aag tgg ggc ggc ctg cac tgg 528
Leu Leu Ala Ser His Tyr Arg Thr Asp Lys Trp Gly Gly Leu His Trp
      165            170            175

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ttc acc ccg cta tac gag cga cac ctc ggc gag ttc cgt gat cgc ccg	576
Phe Thr Pro Leu Tyr Glu Arg His Leu Gly Glu Phe Arg Asp Arg Pro	
180 185 190	
gtg cgc atc ctg gag atc ggt gtc ggt ggc tac aac ttc gac ggt ggc	624
Val Arg Ile Leu Glu Ile Gly Val Gly Gly Tyr Asn Phe Asp Gly Gly	
195 200 205	
ggc ggc gaa tcc ctg aag atg tgg aag cgc tac ttc cac cgc ggc ctc	672
Gly Gly Glu Ser Leu Lys Met Trp Lys Arg Tyr Phe His Arg Gly Leu	
210 215 220	
gtg ttc ggg atg gac gtt ttc gac aag tcc ttc ctc gac cag cag agg	720
Val Phe Gly Met Asp Val Phe Asp Lys Ser Phe Leu Asp Gln Gln Arg	
225 230 235 240	
ctc tgc acc gtc cgc gcc gac cag agc aag ccc gag gag ctg gcc gcc	768
Leu Cys Thr Val Arg Ala Asp Gln Ser Lys Pro Glu Glu Leu Ala Ala	
245 250 255	
gtt gac gac aag tac gga ccg ttc gac atc atc atc gac gat ggc agc	816
Val Asp Asp Lys Tyr Gly Pro Phe Asp Ile Ile Ile Asp Asp Gly Ser	
260 265 270	
cac atc aac gga cac gtg cgc aca tcc ctg gaa acg ctg ttc ccc ccg	864
His Ile Asn Gly His Val Arg Thr Ser Leu Glu Thr Leu Phe Pro Arg	
275 280 285	
ttg cgc agc ggt ggc gta tac gtg atc gag gat ctg tgg acg acc tat	912
Leu Arg Ser Gly Gly Val Tyr Val Ile Glu Asp Leu Trp Thr Thr Tyr	
290 295 300	
gct ccc gga ttc ggc ggg cag gcg cag tgc ccg gcc gca ccc ggc acc	960
Ala Pro Gly Phe Gly Gly Gln Ala Gln Cys Pro Ala Ala Pro Gly Thr	
305 310 315 320	
acg gtc agc ctg ctc aag aac ctg ttg gaa ggc gtt cag cac gag gag	1008
Thr Val Ser Leu Leu Lys Asn Leu Leu Glu Gly Val Gln His Glu Glu	
325 330 335	
cag ccg cat gcg ggc tcg tac gag ccg agc tac ctg gaa cgc aat ttg	1056
Gln Pro His Ala Gly Ser Tyr Glu Pro Ser Tyr Leu Glu Arg Asn Leu	
340 345 350	
gtc ggc ctc cac acc tac cac aac atc gcg ttc ctg gag aaa ggc gtc	1104
Val Gly Leu His Thr Tyr His Asn Ile Ala Phe Leu Glu Lys Gly Val	
355 360 365	

aac gcc gaa ggc ggc gtt cct gct tgg gtg cca agg agt ctg gac gac 1152  
 Asn Ala Glu Gly Gly Val Pro Ala Trp Val Pro Arg Ser Leu Asp Asp  
 370 375 380

ata ttg cac ctg gcc gac gtg aac agc gcg gag gac gag tga 1194  
 Ile Leu His Leu Ala Asp Val Asn Ser Ala Glu Asp Glu  
 385 390 395

<210> 18

<211> 397

<212> PRT

<213> Saccharopolyspora spinosa

<400> 18

Met Ser Thr Thr His Glu Ile Glu Thr Val Glu Arg Ile Ile Leu Ala  
 1 5 10 15

Ala Gly Ser Ser Ala Ala Ser Leu Ala Asp Leu Thr Thr Glu Leu Gly  
 20 25 30

Leu Ala Arg Ile Ala Pro Val Leu Ile Asp Glu Ile Leu Phe Arg Ala  
 35 40 45

Glu Pro Ala Pro Asp Ile Glu Arg Thr Glu Val Ala Val Gln Ile Thr  
 50 55 60

His Arg Gly Glu Thr Val Asp Phe Val Leu Thr Leu Gln Ser Gly Glu  
 65 70 75 80

Leu Ile Lys Ala Glu Gln Arg Pro Val Gly Asp Val Pro Leu Arg Ile  
 85 90 95

Gly Tyr Glu Leu Thr Asp Leu Ile Ala Glu Leu Phe Gly Pro Gly Ala  
 100 105 110

Pro Arg Ala Val Gly Ala Arg Ser Thr Asn Phe Leu Arg Thr Thr Thr  
 115 120 125

Ser Gly Ser Ile Pro Gly Pro Ser Glu Leu Ser Asp Gly Phe Gln Ala  
 130 135 140

Ile Ser Ala Val Val Ala Gly Cys Gly His Arg Arg Pro Asp Leu Asn  
 145 150 155 160

Leu Leu Ala Ser His Tyr Arg Thr Asp Lys Trp Gly Gly Leu His Trp  
 165 170 175

Phe Thr Pro Leu Tyr Glu Arg His Leu Gly Glu Phe Arg Asp Arg Pro  
 180 185 190  
 Val Arg Ile Leu Glu Ile Gly Val Gly Gly Tyr Asn Phe Asp Gly Gly  
 195 200 205  
 Gly Gly Glu Ser Leu Lys Met Trp Lys Arg Tyr Phe His Arg Gly Leu  
 210 215 220  
 Val Phe Gly Met Asp Val Phe Asp Lys Ser Phe Leu Asp Gln Gln Arg  
 225 230 235 240  
 Leu Cys Thr Val Arg Ala Asp Gln Ser Lys Pro Glu Glu Leu Ala Ala  
 245 250 255  
 Val Asp Asp Lys Tyr Gly Pro Phe Asp Ile Ile Ile Asp Asp Gly Ser  
 260 265 270  
 His Ile Asn Gly His Val Arg Thr Ser Leu Glu Thr Leu Phe Pro Arg  
 275 280 285  
 Leu Arg Ser Gly Gly Val Tyr Val Ile Glu Asp Leu Trp Thr Thr Tyr  
 290 295 300  
 Ala Pro Gly Phe Gly Gly Gln Ala Gln Cys Pro Ala Ala Pro Gly Thr  
 305 310 315 320  
 Thr Val Ser Leu Leu Lys Asn Leu Leu Glu Gly Val Gln His Glu Glu  
 325 330 335  
 Gln Pro His Ala Gly Ser Tyr Glu Pro Ser Tyr Leu Glu Arg Asn Leu  
 340 345 350  
 Val Gly Leu His Thr Tyr His Asn Ile Ala Phe Leu Glu Lys Gly Val  
 355 360 365  
 Asn Ala Glu Gly Gly Val Pro Ala Trp Val Pro Arg Ser Leu Asp Asp  
 370 375 380  
 Ile Leu His Leu Ala Asp Val Asn Ser Ala Glu Asp Glu  
 385 390 395

<210> 19  
 <211> 900  
 <212> DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(897)

&lt;223&gt; ORF7; O-Methyltransferase

&lt;400&gt; 19

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gtg aac agc aga ggg gcg aac aca cag gca ttt ccg acc gcg gat cag 48
Val Asn Ser Arg Gly Ala Asn Thr Gln Ala Phe Pro Thr Ala Asp Gln
  1           5           10           15

gtg gag tcc atc ttc gat gcg ttg gcg cac ggg cgt ccc ctg cac cac 96
Val Glu Ser Ile Phe Asp Ala Leu Ala His Gly Arg Pro Leu His His
      20           25           30

ggg tac tgg gcg ggc ggg tat cgg gag gat gcc ggt gcc aca ccg tgg 144
Gly Tyr Trp Ala Gly Gly Tyr Arg Glu Asp Ala Gly Ala Thr Pro Trp
      35           40           45

tcg gat gct gcc gac caa ctg acc gac ctg ttc atc gac aag gcc gcg 192
Ser Asp Ala Ala Asp Gln Leu Thr Asp Leu Phe Ile Asp Lys Ala Ala
      50           55           60

ctc cgt ccc gga gcg cac ctg ttc gac ctg ggc tgc ggc aat ggg cag 240
Leu Arg Pro Gly Ala His Leu Phe Asp Leu Gly Cys Gly Asn Gly Gln
      65           70           75           80

ccc gta gtc cgt gcg gca tgc gcc agc ggc gtt cga gtc acc gga atc 288
Pro Val Val Arg Ala Ala Cys Ala Ser Gly Val Arg Val Thr Gly Ile
      85           90           95

acc gtg aac gcc cag cat ctc gcc gcc gcc acc agg ctc gcc aac gag 336
Thr Val Asn Ala Gln His Leu Ala Ala Ala Thr Arg Leu Ala Asn Glu
      100          105          110

acc gga ctg gcc ggc agt ctt gag ttc gat cta gtc gac ggc gcc cag 384
Thr Gly Leu Ala Gly Ser Leu Glu Phe Asp Leu Val Asp Gly Ala Gln
      115          120          125

ctg ccc tac ccg gac ggt ttc ttt cag gcc gca tgg gcg atg cag tcc 432
Leu Pro Tyr Pro Asp Gly Phe Phe Gln Ala Ala Trp Ala Met Gln Ser
      130          135          140

gtc gtg cag atc gtg gac cag gcc gcc gcg atc cgc gag gtc cac cga 480
Val Val Gln Ile Val Asp Gln Ala Ala Ala Ile Arg Glu Val His Arg
      145          150          155          160

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atc ctg gaa ccc ggc ggc cgg ttc gtc ctc gga gac atc atc act cgg 528  
 Ile Leu Glu Pro Gly Gly Arg Phe Val Leu Gly Asp Ile Ile Thr Arg  
 165 170 175

gtt cga ctc ccg gaa gag tac gcg gcg gtt tgg acg ggc acg acc gcc 576  
 Val Arg Leu Pro Glu Glu Tyr Ala Ala Val Trp Thr Gly Thr Thr Ala  
 180 185 190

cat acc ttg aac agc ttc acg gcg ctg gtc agc gaa gcc ggg ttc gag 624  
 His Thr Leu Asn Ser Phe Thr Ala Leu Val Ser Glu Ala Gly Phe Glu  
 195 200 205

att ctc gaa gtc acc gac ctc acg gca cag acc agg tgc atg gtc tcc 672  
 Ile Leu Glu Val Thr Asp Leu Thr Ala Gln Thr Arg Cys Met Val Ser  
 210 215 220

tgg tac gtc gac gag ttg ctc cgg aaa ctc gat gag ctc gcc ggc gtc 720  
 Trp Tyr Val Asp Glu Leu Leu Arg Lys Leu Asp Glu Leu Ala Gly Val  
 225 230 235 240

gag cct gcg gct gtc ggc acc tac cag caa cgc tac ttg gga gac atc 768  
 Glu Pro Ala Ala Val Gly Thr Tyr Gln Gln Arg Tyr Leu Gly Asp Ile  
 245 250 255

gcg gcg aag cac gga ccg gga cca gca cag ctg atc gcc gcg gtt gcg 816  
 Ala Ala Lys His Gly Pro Gly Pro Ala Gln Leu Ile Ala Ala Val Ala  
 260 265 270

gaa tac cgg aaa cat ccg gat tac gcc aga aac gag gaa agc atg ggt 864  
 Glu Tyr Arg Lys His Pro Asp Tyr Ala Arg Asn Glu Glu Ser Met Gly  
 275 280 285

ttc atg ctc ctg cag gct cga aag aag cag tcc tga 900  
 Phe Met Leu Leu Gln Ala Arg Lys Lys Gln Ser  
 290 295

<210> 20

<211> 299

<212> PRT

<213> Saccharopolyspora spinosa

<400> 20

Val Asn Ser Arg Gly Ala Asn Thr Gln Ala Phe Pro Thr Ala Asp Gln  
 1 5 10 15

Val Glu Ser Ile Phe Asp Ala Leu Ala His Gly Arg Pro Leu His His  
 20 25 30

Gly Tyr Trp Ala Gly Gly Tyr Arg Glu Asp Ala Gly Ala Thr Pro Trp  
 35 40 45  
 Ser Asp Ala Ala Asp Gln Leu Thr Asp Leu Phe Ile Asp Lys Ala Ala  
 50 55 60  
 Leu Arg Pro Gly Ala His Leu Phe Asp Leu Gly Cys Gly Asn Gly Gln  
 65 70 75 80  
 Pro Val Val Arg Ala Ala Cys Ala Ser Gly Val Arg Val Thr Gly Ile  
 85 90 95  
 Thr Val Asn Ala Gln His Leu Ala Ala Thr Arg Leu Ala Asn Glu  
 100 105 110  
 Thr Gly Leu Ala Gly Ser Leu Glu Phe Asp Leu Val Asp Gly Ala Gln  
 115 120 125  
 Leu Pro Tyr Pro Asp Gly Phe Phe Gln Ala Ala Trp Ala Met Gln Ser  
 130 135 140  
 Val Val Gln Ile Val Asp Gln Ala Ala Ala Ile Arg Glu Val His Arg  
 145 150 155 160  
 Ile Leu Glu Pro Gly Gly Arg Phe Val Leu Gly Asp Ile Ile Thr Arg  
 165 170 175  
 Val Arg Leu Pro Glu Glu Tyr Ala Ala Val Trp Thr Gly Thr Thr Ala  
 180 185 190  
 His Thr Leu Asn Ser Phe Thr Ala Leu Val Ser Glu Ala Gly Phe Glu  
 195 200 205  
 Ile Leu Glu Val Thr Asp Leu Thr Ala Gln Thr Arg Cys Met Val Ser  
 210 215 220  
 Trp Tyr Val Asp Glu Leu Leu Arg Lys Leu Asp Glu Leu Ala Gly Val  
 225 230 235 240  
 Glu Pro Ala Ala Val Gly Thr Tyr Gln Gln Arg Tyr Leu Gly Asp Ile  
 245 250 255  
 Ala Ala Lys His Gly Pro Gly Pro Ala Gln Leu Ile Ala Ala Val Ala  
 260 265 270  
 Glu Tyr Arg Lys His Pro Asp Tyr Ala Arg Asn Glu Glu Ser Met Gly  
 275 280 285

Phe Met Leu Leu Gln Ala Arg Lys Lys Gln Ser  
290 295

<210> 21

<211> 1167

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1)..(1164)

<223> ORF8; Cyclisierungsenzym

<400> 21

atg gcc tcc gag cac gcc agc ctg gtc ggc gac gat ctg cgg gca ccc 48  
Met Ala Ser Glu His Ala Ser Leu Val Gly Asp Asp Leu Arg Ala Pro  
1 5 10 15

gcg gat gat ccc ttc tac cga ccg ccg acg ccg cta ccg ccg ggt gtc 96  
Ala Asp Asp Pro Phe Tyr Arg Pro Pro Thr Pro Leu Pro Pro Gly Val  
20 25 30

ccg ggc acg ctc ctc agg gcc cgg ccc gtc tcg gca ctg cgc ggc acg 144  
Pro Gly Thr Leu Leu Arg Ala Arg Pro Val Ser Ala Leu Arg Gly Thr  
35 40 45

ggc gaa ccc gtc gca gcc aag gcc tgg caa atc ctc tac cgg tcc aac 192  
Gly Glu Pro Val Ala Ala Lys Ala Trp Gln Ile Leu Tyr Arg Ser Asn  
50 55 60

tcc gcc ctt ggc atg ccg aac gcc gtc tcc ggc acc gtt ctg gtg ccg 240  
Ser Ala Leu Gly Met Pro Asn Ala Val Ser Gly Thr Val Leu Val Pro  
65 70 75 80

aac atc ccg tgg ccg cgc gaa gat cgc ccc atc atc act ttc gca gtg 288  
Asn Ile Pro Trp Pro Arg Glu Asp Arg Pro Ile Ile Thr Phe Ala Val  
85 90 95

ggc acc cac ggc ctc ggt agc caa gtt gcc ccg tcg tac ctg ctt cga 336  
Gly Thr His Gly Leu Gly Ser Gln Val Ala Pro Ser Tyr Leu Leu Arg  
100 105 110

acc gga acc gag ccg gag acc gag ctg atc gcc gtg gcc ctc gac cgc 384  
Thr Gly Thr Glu Pro Glu Thr Glu Leu Ile Ala Val Ala Leu Asp Arg  
115 120 125



ggg tgg gcc gtg gtc atc acc gac tac gaa ggc ctc ggt act cct gga 432  
 Gly Trp Ala Val Val Ile Thr Asp Tyr Glu Gly Leu Gly Thr Pro Gly  
 130 135 140

acc cac acc tac acc gtc ggc agg gcg cag gga cac gcc atg ctc gat 480  
 Thr His Thr Tyr Thr Val Gly Arg Ala Gln Gly His Ala Met Leu Asp  
 145 150 155 160

gcc gcc cgc gct gcg caa cgg cta ccg ggc tcc ggc ctg acg acc gac 528  
 Ala Ala Arg Ala Ala Gln Arg Leu Pro Gly Ser Gly Leu Thr Thr Asp  
 165 170 175

tgc ccg gtc ggc atc tgg ggc tat gcg cag ggt ggg caa gcg tcg gcc 576  
 Cys Pro Val Gly Ile Trp Gly Tyr Ala Gln Gly Gly Gln Ala Ser Ala  
 180 185 190

ttc gcc ggc gaa ctg cac ccc acc tac gca cct gaa ctg cga atc cgc 624  
 Phe Ala Gly Glu Leu His Pro Thr Tyr Ala Pro Glu Leu Arg Ile Arg  
 195 200 205

gct gcg gcc gca ggt gcg gtg ccg atc gat ctg ctg gac atc atc cac 672  
 Ala Ala Ala Ala Gly Ala Val Pro Ile Asp Leu Leu Asp Ile Ile His  
 210 215 220

cga aat gac ggg gtg ttc acc ggg ccg gtg ctg gcc ggc ctg gtc ggg 720  
 Arg Asn Asp Gly Val Phe Thr Gly Pro Val Leu Ala Gly Leu Val Gly  
 225 230 235 240

cat gcc gct gcc tac ccc gat ctg cca ttc gac gag ctt ctc acc gaa 768  
 His Ala Ala Ala Tyr Pro Asp Leu Pro Phe Asp Glu Leu Leu Thr Glu  
 245 250 255

gcg ggt cgt acc gcc gtt gat caa gtg cgc gag ctc ggt gca ccg gag 816  
 Ala Gly Arg Thr Ala Val Asp Gln Val Arg Glu Leu Gly Ala Pro Glu  
 260 265 270

ctc gtc acc cgc ttc ctc ggc cgc gag ctg agc gac ttc ctc gac act 864  
 Leu Val Thr Arg Phe Leu Gly Arg Glu Leu Ser Asp Phe Leu Asp Thr  
 275 280 285

tcc ggc ctt ttc gag caa cct cga tgg cgc gca cga ctg gcc gaa agc 912  
 Ser Gly Leu Phe Glu Gln Pro Arg Trp Arg Ala Arg Leu Ala Glu Ser  
 290 295 300

gtc gca ggt agg aac ggt ggc ccg gtg gtc ccc acg ctc gtc tac cac 960  
 Val Ala Gly Arg Asn Gly Gly Pro Val Val Pro Thr Leu Val Tyr His  
 305 310 315 320

agc acg gac gac gag atc gtt ccg ttc gca ttc ggc gag cga ctc cgg 1008  
 Ser Thr Asp Asp Glu Ile Val Pro Phe Ala Phe Gly Glu Arg Leu Arg  
 325 330 335

gac agc tac cgc gcg gcg ggt acg cca gtg cgg tgg cat ccg ctc tcc 1056  
 Asp Ser Tyr Arg Ala Ala Gly Thr Pro Val Arg Trp His Pro Leu Ser  
 340 345 350

gga ttg gct cac ttt ccc gcc gcc ctg gcc agc tcg cga gtg gtc gtc 1104  
 Gly Leu Ala His Phe Pro Ala Ala Leu Ala Ser Ser Arg Val Val Val  
 355 360 365

tcg tgg ttc gac gag cac ttc tcc gag ccg tcc gcg atc agc ggt ccg 1152  
 Ser Trp Phe Asp Glu His Phe Ser Glu Pro Ser Ala Ile Ser Gly Pro  
 370 375 380

cga gat gcc agg tga 1167  
 Arg Asp Ala Arg  
 385

<210> 22

<211> 388

<212> PRT

<213> Saccharopolyspora spinosa

<400> 22

Met Ala Ser Glu His Ala Ser Leu Val Gly Asp Asp Leu Arg Ala Pro  
 1 5 10 15

Ala Asp Asp Pro Phe Tyr Arg Pro Pro Thr Pro Leu Pro Pro Gly Val  
 20 25 30

Pro Gly Thr Leu Leu Arg Ala Arg Pro Val Ser Ala Leu Arg Gly Thr  
 35 40 45

Gly Glu Pro Val Ala Ala Lys Ala Trp Gln Ile Leu Tyr Arg Ser Asn  
 50 55 60

Ser Ala Leu Gly Met Pro Asn Ala Val Ser Gly Thr Val Leu Val Pro  
 65 70 75 80

Asn Ile Pro Trp Pro Arg Glu Asp Arg Pro Ile Ile Thr Phe Ala Val  
 85 90 95

Gly Thr His Gly Leu Gly Ser Gln Val Ala Pro Ser Tyr Leu Leu Arg  
 100 105 110

Thr Gly Thr Glu Pro Glu Thr Glu Leu Ile Ala Val Ala Leu Asp Arg  
 115 120 125

Gly Trp Ala Val Val Ile Thr Asp Tyr Glu Gly Leu Gly Thr Pro Gly  
 130 135 140

Thr His Thr Tyr Thr Val Gly Arg Ala Gln Gly His Ala Met Leu Asp  
 145 150 155 160

Ala Ala Arg Ala Ala Gln Arg Leu Pro Gly Ser Gly Leu Thr Thr Asp  
 165 170 175

Cys Pro Val Gly Ile Trp Gly Tyr Ala Gln Gly Gly Gln Ala Ser Ala  
 180 185 190

Phe Ala Gly Glu Leu His Pro Thr Tyr Ala Pro Glu Leu Arg Ile Arg  
 195 200 205

Ala Ala Ala Ala Gly Ala Val Pro Ile Asp Leu Leu Asp Ile Ile His  
 210 215 220

Arg Asn Asp Gly Val Phe Thr Gly Pro Val Leu Ala Gly Leu Val Gly  
 225 230 235 240

His Ala Ala Ala Tyr Pro Asp Leu Pro Phe Asp Glu Leu Leu Thr Glu  
 245 250 255

Ala Gly Arg Thr Ala Val Asp Gln Val Arg Glu Leu Gly Ala Pro Glu  
 260 265 270

Leu Val Thr Arg Phe Leu Gly Arg Glu Leu Ser Asp Phe Leu Asp Thr  
 275 280 285

Ser Gly Leu Phe Glu Gln Pro Arg Trp Arg Ala Arg Leu Ala Glu Ser  
 290 295 300

Val Ala Gly Arg Asn Gly Gly Pro Val Val Pro Thr Leu Val Tyr His  
 305 310 315 320

Ser Thr Asp Asp Glu Ile Val Pro Phe Ala Phe Gly Glu Arg Leu Arg  
 325 330 335

Asp Ser Tyr Arg Ala Ala Gly Thr Pro Val Arg Trp His Pro Leu Ser  
 340 345 350

Gly Leu Ala His Phe Pro Ala Ala Leu Ala Ser Ser Arg Val Val Val  
 355 360 365

Ser Trp Phe Asp Glu His Phe Ser Glu Pro Ser Ala Ile Ser Gly Pro  
 370 375 380

Arg Asp Ala Arg  
 385

<210> 23

<211> 1011

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1)..(1008)

<223> ORF9; 2,3-Reduktase

<400> 23

atg acc agc tcg atg cga aag ccg gtg cgc atc ggt gtg ctc ggg tgc	48
Met Thr Ser Ser Met Arg Lys Pro Val Arg Ile Gly Val Leu Gly Cys	
1 5 10 15	
gct tcc ttc gcg tgg cga cgg atg ctg ccc gcg atg tgc gac gtg gcc	96
Ala Ser Phe Ala Trp Arg Arg Met Leu Pro Ala Met Cys Asp Val Ala	
20 25 30	
gaa aca gag gtg gtg gcg gtg gcg agc cgt gat ccg gcg aaa gcc gaa	144
Glu Thr Glu Val Val Ala Val Ala Ser Arg Asp Pro Ala Lys Ala Glu	
35 40 45	
cgg ttc gca gcg cga ttc gaa tgc gag gcg gtg ctg ggt tac cag cgg	192
Arg Phe Ala Ala Arg Phe Glu Cys Glu Ala Val Leu Gly Tyr Gln Arg	
50 55 60	
ctc ctg gag ccg ccg gac atc gat gcc gtc tac gtg ccg ttg ccg cct	240
Leu Leu Glu Arg Pro Asp Ile Asp Ala Val Tyr Val Pro Leu Pro Pro	
65 70 75 80	
ggc atg cat gca gag tgg atc ggc aag gcg ctt gag gca gac aaa cac	288
Gly Met His Ala Glu Trp Ile Gly Lys Ala Leu Glu Ala Asp Lys His	
85 90 95	
gtg ctt gcg gag aaa ccg ctg acg acg acg gcg tcc gac acc gct cgc	336
Val Leu Ala Glu Lys Pro Leu Thr Thr Thr Ala Ser Asp Thr Ala Arg	
100 105 110	

ctg gtc ggg ctg gcc agg agg aag aac ctg ctg ctg cgg gag aat tac	384
Leu Val Gly Leu Ala Arg Arg Lys Asn Leu Leu Leu Arg Glu Asn Tyr	
115 120 125	
ctg ttc ctc cac cac ggc cgg cac gac gtg gtc cgc gac ctg ctg caa	432
Leu Phe Leu His His Gly Arg His Asp Val Val Arg Asp Leu Leu Gln	
130 135 140	
tcc ggg gag atc ggt gag ctc cgg gag ttc acc gcc gtg ttc gga att	480
Ser Gly Glu Ile Gly Glu Leu Arg Glu Phe Thr Ala Val Phe Gly Ile	
145 150 155 160	
ccg ccg ctt ccc gac acg gac atc cgc tat cgc acc gaa ctc ggt ggc	528
Pro Pro Leu Pro Asp Thr Asp Ile Arg Tyr Arg Thr Glu Leu Gly Gly	
165 170 175	
gga gcg ttg ctg gac atc ggt gtc tat ccc gcc cgt gcc gct cgg cac	576
Gly Ala Leu Leu Asp Ile Gly Val Tyr Pro Ala Arg Ala Ala Arg His	
180 185 190	
ttt ctc ctc ggt ccg ctc acg gtt ctc ggc gca agc tcg cac gag gcc	624
Phe Leu Leu Gly Pro Leu Thr Val Leu Gly Ala Ser Ser His Glu Ala	
195 200 205	
cag gag tcg ggc gtc gac ttg tcg ggc agc gtg ctg ctc caa tcg gaa	672
Gln Glu Ser Gly Val Asp Leu Ser Gly Ser Val Leu Leu Gln Ser Glu	
210 215 220	
ggt ggc acc gtt gcc cac ctc gga tac ggt ttc gtg cac cac tac cgc	720
Gly Gly Thr Val Ala His Leu Gly Tyr Gly Phe Val His His Tyr Arg	
225 230 235 240	
agc gcg tac gag ctg tgg ggg agt cgt ggg cga atc gtc gtc gac cgg	768
Ser Ala Tyr Glu Leu Trp Gly Ser Arg Gly Arg Ile Val Val Asp Arg	
245 250 255	
gcg ttc acg ccg ccc gcc gag tgg cag gcc gtg atc cga atc gag cgg	816
Ala Phe Thr Pro Pro Ala Glu Trp Gln Ala Val Ile Arg Ile Glu Arg	
260 265 270	
aag ggc gtt gtc gac gag ttg tcc ttg cca gcg gaa gat cag gtt cgc	864
Lys Gly Val Val Asp Glu Leu Ser Leu Pro Ala Glu Asp Gln Val Arg	
275 280 285	
aag gcg gtc acc gcc ttc gca cgc gac atc aga gca ggg aca ggc gtg	912
Lys Ala Val Thr Ala Phe Ala Arg Asp Ile Arg Ala Gly Thr Gly Val	
290 295 300	

gac gac cct gcg gtg gcc gga gat tcg ggc gaa tcg atg atc cag cag 960  
 Asp Asp Pro Ala Val Ala Gly Asp Ser Gly Glu Ser Met Ile Gln Gln  
 305 310 315 320

gcc gcg ctg gtg gag gcg atc ggt cag gcc cgt cgg tgc ggg tcc aca 1008  
 Ala Ala Leu Val Glu Ala Ile Gly Gln Ala Arg Arg Cys Gly Ser Thr  
 325 330 335

tag 1011

<210> 24

<211> 336

<212> PRT

<213> Saccharopolyspora spinosa

<400> 24

Met Thr Ser Ser Met Arg Lys Pro Val Arg Ile Gly Val Leu Gly Cys  
 1 5 10 15

Ala Ser Phe Ala Trp Arg Arg Met Leu Pro Ala Met Cys Asp Val Ala  
 20 25 30

Glu Thr Glu Val Val Ala Val Ala Ser Arg Asp Pro Ala Lys Ala Glu  
 35 40 45

Arg Phe Ala Ala Arg Phe Glu Cys Glu Ala Val Leu Gly Tyr Gln Arg  
 50 55 60

Leu Leu Glu Arg Pro Asp Ile Asp Ala Val Tyr Val Pro Leu Pro Pro  
 65 70 75 80

Gly Met His Ala Glu Trp Ile Gly Lys Ala Leu Glu Ala Asp Lys His  
 85 90 95

Val Leu Ala Glu Lys Pro Leu Thr Thr Thr Ala Ser Asp Thr Ala Arg  
 100 105 110

Leu Val Gly Leu Ala Arg Arg Lys Asn Leu Leu Leu Arg Glu Asn Tyr  
 115 120 125

Leu Phe Leu His His Gly Arg His Asp Val Val Arg Asp Leu Leu Gln  
 130 135 140

Ser Gly Glu Ile Gly Glu Leu Arg Glu Phe Thr Ala Val Phe Gly Ile  
 145 150 155 160

Pro Pro Leu Pro Asp Thr Asp Ile Arg Tyr Arg Thr Glu Leu Gly Gly

	165	170	175
Gly Ala Leu Leu Asp Ile Gly Val Tyr Pro Ala Arg Ala Ala Arg His			
	180	185	190
Phe Leu Leu Gly Pro Leu Thr Val Leu Gly Ala Ser Ser His Glu Ala			
	195	200	205
Gln Glu Ser Gly Val Asp Leu Ser Gly Ser Val Leu Leu Gln Ser Glu			
	210	215	220
Gly Gly Thr Val Ala His Leu Gly Tyr Gly Phe Val His His Tyr Arg			
	225	230	235 240
Ser Ala Tyr Glu Leu Trp Gly Ser Arg Gly Arg Ile Val Val Asp Arg			
	245	250	255
Ala Phe Thr Pro Pro Ala Glu Trp Gln Ala Val Ile Arg Ile Glu Arg			
	260	265	270
Lys Gly Val Val Asp Glu Leu Ser Leu Pro Ala Glu Asp Gln Val Arg			
	275	280	285
Lys Ala Val Thr Ala Phe Ala Arg Asp Ile Arg Ala Gly Thr Gly Val			
	290	295	300
Asp Asp Pro Ala Val Ala Gly Asp Ser Gly Glu Ser Met Ile Gln Gln			
	305	310	315 320
Ala Ala Leu Val Glu Ala Ile Gly Gln Ala Arg Arg Cys Gly Ser Thr			
	325	330	335

&lt;210&gt; 25

&lt;211&gt; 1461

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(1458)

&lt;223&gt; ORF10; 2,3-Dehydratase

&lt;400&gt; 25

atg agc agt tct gtc gaa gct gag gca agt gct gct gcg ccg ctc ggc 48

Met Ser Ser Ser Val Glu Ala Glu Ala Ser Ala Ala Ala Pro Leu Gly

1

5

10

15

agc aac aac acg cgg cgg ttc gtc gac tct gcg ctg agc gct tgc aat	96
Ser Asn Asn Thr Arg Arg Phe Val Asp Ser Ala Leu Ser Ala Cys Asn	
20 25 30	
ggc atg att ccg acc acg gag ttc cac tgc tgg ctc gcc gat cgg ctg	144
Gly Met Ile Pro Thr Thr Glu Phe His Cys Trp Leu Ala Asp Arg Leu	
35 40 45	
ggc gag aac agc ttc gag acc aat cgc atc ccg ttc gac cgc ctg tcg	192
Gly Glu Asn Ser Phe Glu Thr Asn Arg Ile Pro Phe Asp Arg Leu Ser	
50 55 60	
aaa tgg aaa ttc gat gcc agc acg gag aac ctg gtt cat gcc gac ggt	240
Lys Trp Lys Phe Asp Ala Ser Thr Glu Asn Leu Val His Ala Asp Gly	
65 70 75 80	
agg ttc ttc acg gta gaa ggc ctg cag gtc gag acc aac tat ggc gcg	288
Arg Phe Phe Thr Val Glu Gly Leu Gln Val Glu Thr Asn Tyr Gly Ala	
85 90 95	
gca ccc agc tgg cac cag ccg atc atc aac cag gct gaa gta ggt atc	336
Ala Pro Ser Trp His Gln Pro Ile Ile Asn Gln Ala Glu Val Gly Ile	
100 105 110	
ctc ggc att ctc gtc aag gag atc gac ggc gtg ctg cac tgc ctc atg	384
Leu Gly Ile Leu Val Lys Glu Ile Asp Gly Val Leu His Cys Leu Met	
115 120 125	
tca gca aag atg gaa ccg ggc aac gtc aac gtc ctg cag ctc tcg ccg	432
Ser Ala Lys Met Glu Pro Gly Asn Val Asn Val Leu Gln Leu Ser Pro	
130 135 140	
acg gtt cag gca act cgg agc aac tac acg cag gca cac cgt ggc agc	480
Thr Val Gln Ala Thr Arg Ser Asn Tyr Thr Gln Ala His Arg Gly Ser	
145 150 155 160	
gtt ccg ccc tat gtg gac tac ttc ctc ggg cgg ggc cgc ggc cgc gtg	528
Val Pro Pro Tyr Val Asp Tyr Phe Leu Gly Arg Gly Arg Gly Arg Val	
165 170 175	
ctg gta gac gtg ctc cag tct gaa cag ggg tcc tgg ttc tac cgg aag	576
Leu Val Asp Val Leu Gln Ser Glu Gln Gly Ser Trp Phe Tyr Arg Lys	
180 185 190	
cgc aac cgg aac atg gtg gtg gaa gtc cag gag gaa gtg cca gtc ctg	624
Arg Asn Arg Asn Met Val Val Glu Val Gln Glu Glu Val Pro Val Leu	
195 200 205	



cca gac ttc tgc tgg ttg acg ctc ggc cag gtg ctg gct ctc ctt cgt	672
Pro Asp Phe Cys Trp Leu Thr Leu Gly Gln Val Leu Ala Leu Leu Arg	
210 215 220	
cag gac aac atc gtc aac atg gac acc cgg acg gtg ctg tct tgc atc	720
Gln Asp Asn Ile Val Asn Met Asp Thr Arg Thr Val Leu Ser Cys Ile	
225 230 235 240	
ccg ttc cac gat tcc gcc acc gga ccc gaa cta gcc gcc tcg gag gag	768
Pro Phe His Asp Ser Ala Thr Gly Pro Glu Leu Ala Ala Ser Glu Glu	
245 250 255	
ccc ttc cga cag gcg gtg gcc agg tcg ctc tcg cac ggc atc gat tcg	816
Pro Phe Arg Gln Ala Val Ala Arg Ser Leu Ser His Gly Ile Asp Ser	
260 265 270	
tcg agt atc tcc gag gcg gtc ggt tgg ttc gag gaa gcc aag gcc cgc	864
Ser Ser Ile Ser Glu Ala Val Gly Trp Phe Glu Glu Ala Lys Ala Arg	
275 280 285	
tac cgc ttg cgg gca acg cgc gtt ccg ctg agc agg gtc gac aag tgg	912
Tyr Arg Leu Arg Ala Thr Arg Val Pro Leu Ser Arg Val Asp Lys Trp	
290 295 300	
tat cgc acc gat acc gag atc gcc cac cag gac ggc aag tac ttc gcg	960
Tyr Arg Thr Asp Thr Glu Ile Ala His Gln Asp Gly Lys Tyr Phe Ala	
305 310 315 320	
gtg atc gcg gtg tcg gtg tcc gcg acc aat cgt gag gtc gcc agc tgg	1008
Val Ile Ala Val Ser Val Ser Ala Thr Asn Arg Glu Val Ala Ser Trp	
325 330 335	
acg cag ccg atg atc gaa ccg cga gaa caa ggt gag atc gca ctg ttg	1056
Thr Gln Pro Met Ile Glu Pro Arg Glu Gln Gly Glu Ile Ala Leu Leu	
340 345 350	
gtc aag ccg atc ggc gga gtg ctg cac ggt ttg gtc cac gct cgg gtg	1104
Val Lys Arg Ile Gly Gly Val Leu His Gly Leu Val His Ala Arg Val	
355 360 365	
gag gct ggg tat aag tgg act gcg gaa atc gct ccc acg gtc cag tgc	1152
Glu Ala Gly Tyr Lys Trp Thr Ala Glu Ile Ala Pro Thr Val Gln Cys	
370 375 380	
agt gtg gcc aac tac caa agc acc ccg tcg aac gac tgg ccg ccg ttc	1200
Ser Val Ala Asn Tyr Gln Ser Thr Pro Ser Asn Asp Trp Pro Pro Phe	
385 390 395 400	

ttg gac gac gtg ctc acc gcc gat ccc gaa acc gtg cgg tac gaa tcg 1248  
 Leu Asp Asp Val Leu Thr Ala Asp Pro Glu Thr Val Arg Tyr Glu Ser  
                     405                    410                    415

atc ctg tcc gaa gaa ggc ggt cgg ttc tac cag gcg cag aac agg tac 1296  
 Ile Leu Ser Glu Glu Gly Gly Arg Phe Tyr Gln Ala Gln Asn Arg Tyr  
                     420                    425                    430

cgg atc atc gag gtg cat gag gac ttc gcg gca cga cct ccc agc gac 1344  
 Arg Ile Ile Glu Val His Glu Asp Phe Ala Ala Arg Pro Pro Ser Asp  
                     435                    440                    445

ttc cgg tgg atg act ttg gga cag ttg ggc gag ctg ctc cgg agc acc 1392  
 Phe Arg Trp Met Thr Leu Gly Gln Leu Gly Glu Leu Leu Arg Ser Thr  
                     450                    455                    460

cac ttc ttg aac atc cag gcg cgc agc ttg gtc gcc tcc ctg cat agc 1440  
 His Phe Leu Asn Ile Gln Ala Arg Ser Leu Val Ala Ser Leu His Ser  
 465                    470                    475                    480

ttg tgg gcg ttg ggg cga tga 1461  
 Leu Trp Ala Leu Gly Arg  
                     485

<210> 26

<211> 486

<212> PRT

<213> Saccharopolyspora spinosa

<400> 26

Met Ser Ser Ser Val Glu Ala Glu Ala Ser Ala Ala Ala Pro Leu Gly  
     1                    5                    10                    15

Ser Asn Asn Thr Arg Arg Phe Val Asp Ser Ala Leu Ser Ala Cys Asn  
                     20                    25                    30

Gly Met Ile Pro Thr Thr Glu Phe His Cys Trp Leu Ala Asp Arg Leu  
                     35                    40                    45

Gly Glu Asn Ser Phe Glu Thr Asn Arg Ile Pro Phe Asp Arg Leu Ser  
                     50                    55                    60

Lys Trp Lys Phe Asp Ala Ser Thr Glu Asn Leu Val His Ala Asp Gly  
                     65                    70                    75                    80

Arg Phe Phe Thr Val Glu Gly Leu Gln Val Glu Thr Asn Tyr Gly Ala

85	90	95
Ala Pro Ser Trp His Gln Pro Ile Ile Asn Gln Ala Glu Val Gly Ile 100	105	110
Leu Gly Ile Leu Val Lys Glu Ile Asp Gly Val Leu His Cys Leu Met 115	120	125
Ser Ala Lys Met Glu Pro Gly Asn Val Asn Val Leu Gln Leu Ser Pro 130	135	140
Thr Val Gln Ala Thr Arg Ser Asn Tyr Thr Gln Ala His Arg Gly Ser 145	150	155 160
Val Pro Pro Tyr Val Asp Tyr Phe Leu Gly Arg Gly Arg Gly Arg Val 165	170	175
Leu Val Asp Val Leu Gln Ser Glu Gln Gly Ser Trp Phe Tyr Arg Lys 180	185	190
Arg Asn Arg Asn Met Val Val Glu Val Gln Glu Glu Val Pro Val Leu 195	200	205
Pro Asp Phe Cys Trp Leu Thr Leu Gly Gln Val Leu Ala Leu Leu Arg 210	215	220
Gln Asp Asn Ile Val Asn Met Asp Thr Arg Thr Val Leu Ser Cys Ile 225	230	235 240
Pro Phe His Asp Ser Ala Thr Gly Pro Glu Leu Ala Ala Ser Glu Glu 245	250	255
Pro Phe Arg Gln Ala Val Ala Arg Ser Leu Ser His Gly Ile Asp Ser 260	265	270
Ser Ser Ile Ser Glu Ala Val Gly Trp Phe Glu Glu Ala Lys Ala Arg 275	280	285
Tyr Arg Leu Arg Ala Thr Arg Val Pro Leu Ser Arg Val Asp Lys Trp 290	295	300
Tyr Arg Thr Asp Thr Glu Ile Ala His Gln Asp Gly Lys Tyr Phe Ala 305	310	315 320
Val Ile Ala Val Ser Val Ser Ala Thr Asn Arg Glu Val Ala Ser Trp 325	330	335
Thr Gln Pro Met Ile Glu Pro Arg Glu Gln Gly Glu Ile Ala Leu Leu		

340                                      345                                      350  
 Val Lys Arg Ile Gly Gly Val Leu His Gly Leu Val His Ala Arg Val  
     355                                      360                                      365  
 Glu Ala Gly Tyr Lys Trp Thr Ala Glu Ile Ala Pro Thr Val Gln Cys  
     370                                      375                                      380  
 Ser Val Ala Asn Tyr Gln Ser Thr Pro Ser Asn Asp Trp Pro Pro Phe  
 385                                      390                                      395                                      400  
 Leu Asp Asp Val Leu Thr Ala Asp Pro Glu Thr Val Arg Tyr Glu Ser  
                                     405                                      410                                      415  
 Ile Leu Ser Glu Glu Gly Gly Arg Phe Tyr Gln Ala Gln Asn Arg Tyr  
                                     420                                      425                                      430  
 Arg Ile Ile Glu Val His Glu Asp Phe Ala Ala Arg Pro Pro Ser Asp  
                                     435                                      440                                      445  
 Phe Arg Trp Met Thr Leu Gly Gln Leu Gly Glu Leu Leu Arg Ser Thr  
                                     450                                      455                                      460  
 His Phe Leu Asn Ile Gln Ala Arg Ser Leu Val Ala Ser Leu His Ser  
 465                                      470                                      475                                      480  
 Leu Trp Ala Leu Gly Arg  
                                     485

<210> 27  
 <211> 524  
 <212> DNA  
 <213> Saccharopolyspora spinosa

<220>  
 <221> CDS  
 <222> (1)..(438)  
 <223> ORF11; Thioesterase

<400> 27  
 gtg agc aac gtg tgg ccg gaa aca tgg acg ccg ggg ttt ggc agg tgt    48  
 Val Ser Asn Val Trp Pro Glu Thr Trp Thr Pro Gly Phe Gly Arg Cys  
     1                                      5                                      10                                      15  
 tca tcg ctg ttg cgt cga ctc gga ttc cgc cgt gac cgg gac gat gcc    96  
 Ser Ser Leu Leu Arg Arg Leu Gly Phe Arg Arg Asp Arg Asp Asp Ala

20	25	30	
agg cga gtc ccg aag tca gat tct tgt cca gaa tcg tcc aat ggg gtg			144
Arg Arg Val Pro Lys Ser Asp Ser Cys Pro Glu Ser Ser Asn Gly Val			
35	40	45	
ttg atc tcc cca gag gtt tgc gct cca acc gat ttc cga cga gga tcg			192
Leu Ile Ser Pro Glu Val Cys Ala Pro Thr Asp Phe Arg Arg Gly Ser			
50	55	60	
tgg cgc ccg ctg agc aac gac tac cgt gcg gtc gag aca tac cgc tgt			240
Trp Arg Pro Leu Ser Asn Asp Tyr Arg Ala Val Glu Thr Tyr Arg Cys			
65	70	75	80
gcg cca gga gcg aag gtg ggt tgc ccg atc acc gtg ctg gtg gta gat			288
Ala Pro Gly Ala Lys Val Gly Cys Pro Ile Thr Val Leu Val Val Asp			
85	90	95	
gcc gag ccg aag gtc acc ttg gat gag gcg gaa gcc tgg cga gag cac			336
Ala Glu Pro Lys Val Thr Leu Asp Glu Ala Glu Ala Trp Arg Glu His			
100	105	110	
acc gag gcc gtg gcc gac gtc cgt gtc ttc tcc ggc ggg cat ttc ttc			384
Thr Glu Ala Val Ala Asp Val Arg Val Phe Ser Gly Gly His Phe Phe			
115	120	125	
atg acc gaa cgc cag gac gag gtg ctc gcg gtc ctt acg ggc gga tcg			432
Met Thr Glu Arg Gln Asp Glu Val Leu Ala Val Leu Thr Gly Gly Ser			
130	135	140	
ctt cga tgatcctcgc caggccgctg gaccagaccg cgacgccctt gggagccggc			488
Leu Arg			
145			
gtgcacatcg tcacggcagt gagggattgg gcatga			524

&lt;210&gt; 28

&lt;211&gt; 146

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 28

Val Ser Asn Val Trp Pro Glu Thr Trp Thr Pro Gly Phe Gly Arg Cys

1

5

10

15

Ser Ser Leu Leu Arg Arg Leu Gly Phe Arg Arg Asp Arg Asp Asp Ala

20

25

30

Arg Arg Val Pro Lys Ser Asp Ser Cys Pro Glu Ser Ser Asn Gly Val  
 35 40 45

Leu Ile Ser Pro Glu Val Cys Ala Pro Thr Asp Phe Arg Arg Gly Ser  
 50 55 60

Trp Arg Pro Leu Ser Asn Asp Tyr Arg Ala Val Glu Thr Tyr Arg Cys  
 65 70 75 80

Ala Pro Gly Ala Lys Val Gly Cys Pro Ile Thr Val Leu Val Val Asp  
 85 90 95

Ala Glu Pro Lys Val Thr Leu Asp Glu Ala Glu Ala Trp Arg Glu His  
 100 105 110

Thr Glu Ala Val Ala Asp Val Arg Val Phe Ser Gly Gly His Phe Phe  
 115 120 125

Met Thr Glu Arg Gln Asp Glu Val Leu Ala Val Leu Thr Gly Gly Ser  
 130 135 140

Leu Arg  
 145

<210> 29

<211> 1320

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1)..(1317)

<223> ORF12; Glycosyltransferase

<400> 29

atg cgt gtc ctg ttc acc ccg ctg ccg gcg agt tcg cac ttc ttc aac 48  
 Met Arg Val Leu Phe Thr Pro Leu Pro Ala Ser Ser His Phe Phe Asn  
 1 5 10 15

ctg gtg ccg ttg gcg tgg gcg ttg cgt gcc gcg ggg cac gag gtc cgt 96  
 Leu Val Pro Leu Ala Trp Ala Leu Arg Ala Ala Gly His Glu Val Arg  
 20 25 30

gtc gcc atc tgc ccg aat atg gtg tcg atg gtc acc gga gca gga ctc 144  
 Val Ala Ile Cys Pro Asn Met Val Ser Met Val Thr Gly Ala Gly Leu

35	40	45	
acc gcg gtt ccc gtc ggc gac gag ctc gac ctc atc tcc ttg gcg gcc			192
Thr Ala Val Pro Val Gly Asp Glu Leu Asp Leu Ile Ser Leu Ala Ala			
50	55	60	
aag aac gaa ctc gtt ctc ggc agc ggg gtc tcg ttc gac gag aag ggg			240
Lys Asn Glu Leu Val Leu Gly Ser Gly Val Ser Phe Asp Glu Lys Gly			
65	70	75	80
cgg cat ccg gaa ctc ttc gac gag ctg ctg tca atc aac tcc ggc aga			288
Arg His Pro Glu Leu Phe Asp Glu Leu Leu Ser Ile Asn Ser Gly Arg			
85	90	95	
gac acg gac gcc gtg gag caa ctc cac ctt gtg gat gac cga tcg ctg			336
Asp Thr Asp Ala Val Glu Gln Leu His Leu Val Asp Asp Arg Ser Leu			
100	105	110	
gac gat ctc atg ggg ttc gcc gag aaa tgg cag cct gat ctc gtt gtg			384
Asp Asp Leu Met Gly Phe Ala Glu Lys Trp Gln Pro Asp Leu Val Val			
115	120	125	
tgg gac gct atg gtg tgt tcg ggg cca gtt gtg gcg cga gcg ctc ggc			432
Trp Asp Ala Met Val Cys Ser Gly Pro Val Val Ala Arg Ala Leu Gly			
130	135	140	
gca cga cac gtg cgg atg ctc gtc gcc ctc gat gtg tcg ggg tgg ctg			480
Ala Arg His Val Arg Met Leu Val Ala Leu Asp Val Ser Gly Trp Leu			
145	150	155	160
cgg tcc ggt ttc ctc gaa tac cag gaa tcg aag ccg cct gag cag cgc			528
Arg Ser Gly Phe Leu Glu Tyr Gln Glu Ser Lys Pro Pro Glu Gln Arg			
165	170	175	
gtc gac ccg ctc ggg acg tgg ctg gga gcg aag ctc gcc aag ttc gga			576
Val Asp Pro Leu Gly Thr Trp Leu Gly Ala Lys Leu Ala Lys Phe Gly			
180	185	190	
gcc acg ttc gat gaa gag atc gtg acg ggc caa gcg acc ata gat ccg			624
Ala Thr Phe Asp Glu Glu Ile Val Thr Gly Gln Ala Thr Ile Asp Pro			
195	200	205	
att cca tcc tgg atg cgc ctg cct gtg gac ttg gac tac atc tcg atg			672
Ile Pro Ser Trp Met Arg Leu Pro Val Asp Leu Asp Tyr Ile Ser Met			
210	215	220	
cgt ttc gtg ccg tac aac ggt ccg gcg gtg ttg ccg gag tgg ttg cgc			720
Arg Phe Val Pro Tyr Asn Gly Pro Ala Val Leu Pro Glu Trp Leu Arg			

225	230	235	240	
gaa cga ccg acg aag ccg cgc gtc tgc atc acg cgc ggg ctg acc aag				768
Glu Arg Pro Thr Lys Pro Arg Val Cys Ile Thr Arg Gly Leu Thr Lys				
245		250	255	
cgg cgg ctg agc agg gtg acc gaa cag tac ggg gag caa agt gac cag				816
Arg Arg Leu Ser Arg Val Thr Glu Gln Tyr Gly Glu Gln Ser Asp Gln				
260		265	270	
gaa caa gca atg gtg gaa agg ttg ttg cgc ggc gcg gcc agg ctc gac				864
Glu Gln Ala Met Val Glu Arg Leu Leu Arg Gly Ala Ala Arg Leu Asp				
275		280	285	
gtc gag gtg atc gcc acc ttg tct gac gac gaa gta cgg gag atg ggg				912
Val Glu Val Ile Ala Thr Leu Ser Asp Asp Glu Val Arg Glu Met Gly				
290		295	300	
gag ttg ccc tcg aac gtc cgg gtc cac gaa tac gta ccg ctc aac gaa				960
Glu Leu Pro Ser Asn Val Arg Val His Glu Tyr Val Pro Leu Asn Glu				
305		310	315	320
ctg ctg gag tcg tgt tca gtg atc atc cat cat ggc tcg acg acg acg				1008
Leu Leu Glu Ser Cys Ser Val Ile Ile His His Gly Ser Thr Thr Thr				
325		330	335	
cag gaa acc gcc acg gtc aac ggc gta ccg cag ttg att ctc cct ggg				1056
Gln Glu Thr Ala Thr Val Asn Gly Val Pro Gln Leu Ile Leu Pro Gly				
340		345	350	
acc ttc tgg gac gaa tct cgt agg gcg gag ctc cta gcc gat cgg gga				1104
Thr Phe Trp Asp Glu Ser Arg Arg Ala Glu Leu Leu Ala Asp Arg Gly				
355		360	365	
gcc ggt ctg gtc ctc gac ccc gcg acg ttt acc gaa gac gac gtg cga				1152
Ala Gly Leu Val Leu Asp Pro Ala Thr Phe Thr Glu Asp Asp Val Arg				
370		375	380	
ggg cag ctg gcc cgc ctg ctc gac gag ccg tcg ttc gct gcc aac gcg				1200
Gly Gln Leu Ala Arg Leu Leu Asp Glu Pro Ser Phe Ala Ala Asn Ala				
385		390	395	400
gcg ctg atc cgc cgt gaa atc gag gaa agt ccc agc ccg cac gac atc				1248
Ala Leu Ile Arg Arg Glu Ile Glu Glu Ser Pro Ser Pro His Asp Ile				
405		410	415	
gtt cca cgt ctg gaa aag cta gtt gcc gaa cgt gag aac cgc cgc act				1296
Val Pro Arg Leu Glu Lys Leu Val Ala Glu Arg Glu Asn Arg Arg Thr				



420

425

430

ggg cag tct gat ggc cat ccg tga  
Gly Gln Ser Asp Gly His Pro

1320

435

&lt;210&gt; 30

&lt;211&gt; 439

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 30

Met Arg Val Leu Phe Thr Pro Leu Pro Ala Ser Ser His Phe Phe Asn  
1 5 10 15

Leu Val Pro Leu Ala Trp Ala Leu Arg Ala Ala Gly His Glu Val Arg  
20 25 30

Val Ala Ile Cys Pro Asn Met Val Ser Met Val Thr Gly Ala Gly Leu  
35 40 45

Thr Ala Val Pro Val Gly Asp Glu Leu Asp Leu Ile Ser Leu Ala Ala  
50 55 60

Lys Asn Glu Leu Val Leu Gly Ser Gly Val Ser Phe Asp Glu Lys Gly  
65 70 75 80

Arg His Pro Glu Leu Phe Asp Glu Leu Leu Ser Ile Asn Ser Gly Arg  
85 90 95

Asp Thr Asp Ala Val Glu Gln Leu His Leu Val Asp Asp Arg Ser Leu  
100 105 110

Asp Asp Leu Met Gly Phe Ala Glu Lys Trp Gln Pro Asp Leu Val Val  
115 120 125

Trp Asp Ala Met Val Cys Ser Gly Pro Val Val Ala Arg Ala Leu Gly  
130 135 140

Ala Arg His Val Arg Met Leu Val Ala Leu Asp Val Ser Gly Trp Leu  
145 150 155 160

Arg Ser Gly Phe Leu Glu Tyr Gln Glu Ser Lys Pro Pro Glu Gln Arg  
165 170 175

Val Asp Pro Leu Gly Thr Trp Leu Gly Ala Lys Leu Ala Lys Phe Gly  
180 185 190

Ala Thr Phe Asp Glu Glu Ile Val Thr Gly Gln Ala Thr Ile Asp Pro  
 195 200 205

Ile Pro Ser Trp Met Arg Leu Pro Val Asp Leu Asp Tyr Ile Ser Met  
 210 215 220

Arg Phe Val Pro Tyr Asn Gly Pro Ala Val Leu Pro Glu Trp Leu Arg  
 225 230 235 240

Glu Arg Pro Thr Lys Pro Arg Val Cys Ile Thr Arg Gly Leu Thr Lys  
 245 250 255

Arg Arg Leu Ser Arg Val Thr Glu Gln Tyr Gly Glu Gln Ser Asp Gln  
 260 265 270

Glu Gln Ala Met Val Glu Arg Leu Leu Arg Gly Ala Ala Arg Leu Asp  
 275 280 285

Val Glu Val Ile Ala Thr Leu Ser Asp Asp Glu Val Arg Glu Met Gly  
 290 295 300

Glu Leu Pro Ser Asn Val Arg Val His Glu Tyr Val Pro Leu Asn Glu  
 305 310 315 320

Leu Leu Glu Ser Cys Ser Val Ile Ile His His Gly Ser Thr Thr Thr  
 325 330 335

Gln Glu Thr Ala Thr Val Asn Gly Val Pro Gln Leu Ile Leu Pro Gly  
 340 345 350

Thr Phe Trp Asp Glu Ser Arg Arg Ala Glu Leu Leu Ala Asp Arg Gly  
 355 360 365

Ala Gly Leu Val Leu Asp Pro Ala Thr Phe Thr Glu Asp Asp Val Arg  
 370 375 380

Gly Gln Leu Ala Arg Leu Leu Asp Glu Pro Ser Phe Ala Ala Asn Ala  
 385 390 395 400

Ala Leu Ile Arg Arg Glu Ile Glu Glu Ser Pro Ser Pro His Asp Ile  
 405 410 415

Val Pro Arg Leu Glu Lys Leu Val Ala Glu Arg Glu Asn Arg Arg Thr  
 420 425 430

Gly Gln Ser Asp Gly His Pro  
 435

<210> 31  
 <211> 1389  
 <212> DNA  
 <213> Saccharopolyspora spinosa

<220>  
 <221> CDS  
 <222> (1) .. (1386)  
 <223> ORF13; 3,4-Dehydratase

<400> 31  
 atg cag agc cgg aaa acc aga gcg ctg ggg aaa ggg cgc gcc aga gtg 48  
 Met Gln Ser Arg Lys Thr Arg Ala Leu Gly Lys Gly Arg Ala Arg Val  
 1 5 10 15  
 act tcg tgt gac gac act tgc gct acc gct act gag atg gtg ccg gat 96  
 Thr Ser Cys Asp Asp Thr Cys Ala Thr Ala Thr Glu Met Val Pro Asp  
 20 25 30  
 gcc aag gac cgg ata ttg gca tcc gta cgc gat tac cac cgc gaa cag 144  
 Ala Lys Asp Arg Ile Leu Ala Ser Val Arg Asp Tyr His Arg Glu Gln  
 35 40 45  
 gaa tcc ccg acc ttc gtg gct gga tcg acg ccg atc cgg cca tcg ggc 192  
 Glu Ser Pro Thr Phe Val Ala Gly Ser Thr Pro Ile Arg Pro Ser Gly  
 50 55 60  
 gcc gtg ctc gac gag gac gac cgg gtg gca ctg gtg gaa gcc gcg ctg 240  
 Ala Val Leu Asp Glu Asp Asp Arg Val Ala Leu Val Glu Ala Ala Leu  
 65 70 75 80  
 gag ctc cgg atc gcc gcg ggc ggg aat gca cgg cga ttc gag agc gag 288  
 Glu Leu Arg Ile Ala Ala Gly Gly Asn Ala Arg Arg Phe Glu Ser Glu  
 85 90 95  
 ttc gcc cgc ttc ttc ggc ctc cgc aag gct cat ctc gtc aac tcc ggt 336  
 Phe Ala Arg Phe Phe Gly Leu Arg Lys Ala His Leu Val Asn Ser Gly  
 100 105 110  
 tcg tcg gcc aat ctc ctg gca ctg agt tcg ctt acc tcc ccc aaa ctc 384  
 Ser Ser Ala Asn Leu Leu Ala Leu Ser Ser Leu Thr Ser Pro Lys Leu  
 115 120 125  
 ggc gag gca cga ctg cgg ccc ggc gac gaa gtg atc act gcg gcg gtc 432  
 Gly Glu Ala Arg Leu Arg Pro Gly Asp Glu Val Ile Thr Ala Ala Val

130	135	140	
ggc ttc ccc acg acg atc aat ccg gcg gtc caa aac gga ctc gtc ccg			480
Gly Phe Pro Thr Thr Ile Asn Pro Ala Val Gln Asn Gly Leu Val Pro			
145	150	155	160
gta ttc gtc gac gtg gaa ctg ggc acc tac aac gca acg cca gac cgc			528
Val Phe Val Asp Val Glu Leu Gly Thr Tyr Asn Ala Thr Pro Asp Arg			
165	170	175	
atc aag gcc gcc gtc acg gaa cgg acg cga gcc atc atg ctg gcg cac			576
Ile Lys Ala Ala Val Thr Glu Arg Thr Arg Ala Ile Met Leu Ala His			
180	185	190	
acc ctg ggc aac ccc ttc gcc gct gac gaa atc gcg gag atc gca aaa			624
Thr Leu Gly Asn Pro Phe Ala Ala Asp Glu Ile Ala Glu Ile Ala Lys			
195	200	205	
gaa cac gag ctg ttc ctc gtc gaa gac aac tgt gat gcg gtg gga tcc			672
Glu His Glu Leu Phe Leu Val Glu Asp Asn Cys Asp Ala Val Gly Ser			
210	215	220	
acc tac cgg gga cgg ctg acc gga acc ttc ggc gac ctg aca acg gtc			720
Thr Tyr Arg Gly Arg Leu Thr Gly Thr Phe Gly Asp Leu Thr Thr Val			
225	230	235	240
agc ttc tat cct gcc cat cac atc acc agc ggc gag ggt ggc tgc gtg			768
Ser Phe Tyr Pro Ala His His Ile Thr Ser Gly Glu Gly Gly Cys Val			
245	250	255	
ttg acc ggc agc ctg gaa ttg gct cgc atc atc gag tcg ctg cgt gac			816
Leu Thr Gly Ser Leu Glu Leu Ala Arg Ile Ile Glu Ser Leu Arg Asp			
260	265	270	
tgg gga cgg gat tgc tgg tgc gag ccc ggc gtg gac aac acc tgc cgc			864
Trp Gly Arg Asp Cys Trp Cys Glu Pro Gly Val Asp Asn Thr Cys Arg			
275	280	285	
aag agg ttc gac tac cac ctc ggt acc ctt cca ccg ggc tac gac cac			912
Lys Arg Phe Asp Tyr His Leu Gly Thr Leu Pro Pro Gly Tyr Asp His			
290	295	300	
aag tac acg ttc tcc cac gtc ggt tac aac ctc aag acc acc gac ctg			960
Lys Tyr Thr Phe Ser His Val Gly Tyr Asn Leu Lys Thr Thr Asp Leu			
305	310	315	320
cag gcc gca ctt gcg ctg agc cag ttg agc aag att tcc gca ttc ggg			1008
Gln Ala Ala Leu Ala Leu Ser Gln Leu Ser Lys Ile Ser Ala Phe Gly			

325

330

335

tcg gca cgc cgc cgt aac tgg cga cgg ttg cgc gaa ggg ctg tcc ggg 1056  
 Ser Ala Arg Arg Arg Asn Trp Arg Arg Leu Arg Glu Gly Leu Ser Gly  
 340 345 350

ttg ccg ggc ctg ctg ctg ccg gta gcc aca ccg cac agc gac ccg agc 1104  
 Leu Pro Gly Leu Leu Leu Pro Val Ala Thr Pro His Ser Asp Pro Ser  
 355 360 365

tgg ttc ggg ttt gcg atc acc atc agt gcg gac gcc ggg ttc acc cgt 1152  
 Trp Phe Gly Phe Ala Ile Thr Ile Ser Ala Asp Ala Gly Phe Thr Arg  
 370 375 380

gcc gcc ctg gtg aac ttc ctg gaa tcc cgc aac atc ggc acc cga ctg 1200  
 Ala Ala Leu Val Asn Phe Leu Glu Ser Arg Asn Ile Gly Thr Arg Leu  
 385 390 395 400

ctg ttc ggc ggt aac atc acc cgg cac ccg gcc ttc gag cag gtg cgg 1248  
 Leu Phe Gly Gly Asn Ile Thr Arg His Pro Ala Phe Glu Gln Val Arg  
 405 410 415

tac cgg atc gcc gac gcg ctc acc aac agc gac atc gtc acc gac cga 1296  
 Tyr Arg Ile Ala Asp Ala Leu Thr Asn Ser Asp Ile Val Thr Asp Arg  
 420 425 430

acc ttc tgg gtc ggc gtc tac cca ggc ata acg gac caa atg atc gac 1344  
 Thr Phe Trp Val Gly Val Tyr Pro Gly Ile Thr Asp Gln Met Ile Asp  
 435 440 445

tac gtc gtc gaa tca atc gct gaa ttc gtg gcc aag agt tcc tag 1389  
 Tyr Val Val Glu Ser Ile Ala Glu Phe Val Ala Lys Ser Ser  
 450 455 460

&lt;210&gt; 32

&lt;211&gt; 462

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 32

Met Gln Ser Arg Lys Thr Arg Ala Leu Gly Lys Gly Arg Ala Arg Val  
 1 5 10 15

Thr Ser Cys Asp Asp Thr Cys Ala Thr Ala Thr Glu Met Val Pro Asp  
 20 25 30

Ala Lys Asp Arg Ile Leu Ala Ser Val Arg Asp Tyr His Arg Glu Gln

35	40	45
Glu Ser Pro Thr Phe Val Ala Gly Ser Thr Pro Ile Arg Pro Ser Gly		
50	55	60
Ala Val Leu Asp Glu Asp Asp Arg Val Ala Leu Val Glu Ala Ala Leu		
65	70	75
Glu Leu Arg Ile Ala Ala Gly Gly Asn Ala Arg Arg Phe Glu Ser Glu		
85	90	95
Phe Ala Arg Phe Phe Gly Leu Arg Lys Ala His Leu Val Asn Ser Gly		
100	105	110
Ser Ser Ala Asn Leu Leu Ala Leu Ser Ser Leu Thr Ser Pro Lys Leu		
115	120	125
Gly Glu Ala Arg Leu Arg Pro Gly Asp Glu Val Ile Thr Ala Ala Val		
130	135	140
Gly Phe Pro Thr Thr Ile Asn Pro Ala Val Gln Asn Gly Leu Val Pro		
145	150	155
Val Phe Val Asp Val Glu Leu Gly Thr Tyr Asn Ala Thr Pro Asp Arg		
165	170	175
Ile Lys Ala Ala Val Thr Glu Arg Thr Arg Ala Ile Met Leu Ala His		
180	185	190
Thr Leu Gly Asn Pro Phe Ala Ala Asp Glu Ile Ala Glu Ile Ala Lys		
195	200	205
Glu His Glu Leu Phe Leu Val Glu Asp Asn Cys Asp Ala Val Gly Ser		
210	215	220
Thr Tyr Arg Gly Arg Leu Thr Gly Thr Phe Gly Asp Leu Thr Thr Val		
225	230	235
Ser Phe Tyr Pro Ala His His Ile Thr Ser Gly Glu Gly Gly Cys Val		
245	250	255
Leu Thr Gly Ser Leu Glu Leu Ala Arg Ile Ile Glu Ser Leu Arg Asp		
260	265	270
Trp Gly Arg Asp Cys Trp Cys Glu Pro Gly Val Asp Asn Thr Cys Arg		
275	280	285
Lys Arg Phe Asp Tyr His Leu Gly Thr Leu Pro Pro Gly Tyr Asp His		

290

295

300

Lys Tyr Thr Phe Ser His Val Gly Tyr Asn Leu Lys Thr Thr Asp Leu  
 305 310 315 320

Gln Ala Ala Leu Ala Leu Ser Gln Leu Ser Lys Ile Ser Ala Phe Gly  
 325 330 335

Ser Ala Arg Arg Arg Asn Trp Arg Arg Leu Arg Glu Gly Leu Ser Gly  
 340 345 350

Leu Pro Gly Leu Leu Leu Pro Val Ala Thr Pro His Ser Asp Pro Ser  
 355 360 365

Trp Phe Gly Phe Ala Ile Thr Ile Ser Ala Asp Ala Gly Phe Thr Arg  
 370 375 380

Ala Ala Leu Val Asn Phe Leu Glu Ser Arg Asn Ile Gly Thr Arg Leu  
 385 390 395 400

Leu Phe Gly Gly Asn Ile Thr Arg His Pro Ala Phe Glu Gln Val Arg  
 405 410 415

Tyr Arg Ile Ala Asp Ala Leu Thr Asn Ser Asp Ile Val Thr Asp Arg  
 420 425 430

Thr Phe Trp Val Gly Val Tyr Pro Gly Ile Thr Asp Gln Met Ile Asp  
 435 440 445

Tyr Val Val Glu Ser Ile Ala Glu Phe Val Ala Lys Ser Ser  
 450 455 460

&lt;210&gt; 33

&lt;211&gt; 1158

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(1155)

&lt;223&gt; ORF14; 4-Aminotransferase

&lt;400&gt; 33

gtg atc aac ctg cac cag ccg atc ctc ggc acc gaa gaa ctc gac gcg 48  
 Val Ile Asn Leu His Gln Pro Ile Leu Gly Thr Glu Glu Leu Asp Ala

1

5

10

15

atc gcg gag gtg ttc gcc tcc aac tgg atc ggg ctc ggg ccg cgc acc	96
Ile Ala Glu Val Phe Ala Ser Asn Trp Ile Gly Leu Gly Pro Arg Thr	
20 25 30	
cgg acg ttc gag gcc gaa ttc gcc cac cac ctg gga gtg gat ccc gaa	144
Arg Thr Phe Glu Ala Glu Phe Ala His His Leu Gly Val Asp Pro Glu	
35 40 45	
cag gtc gtg ttc ctc aac tcg ggg act gcc gcg ctg ttc ctt acc gtg	192
Gln Val Val Phe Leu Asn Ser Gly Thr Ala Ala Leu Phe Leu Thr Val	
50 55 60	
cag gtg ctc gac ctc ggc cca ggc gac gac gtg gta ctt cct tcg ata	240
Gln Val Leu Asp Leu Gly Pro Gly Asp Asp Val Val Leu Pro Ser Ile	
65 70 75 80	
agc ttc gtg gcg gcg gcc aac gcc atc gca tcc tcc ggt gcc cgc ccg	288
Ser Phe Val Ala Ala Ala Asn Ala Ile Ala Ser Ser Gly Ala Arg Pro	
85 90 95	
gtg ttc tgc gac gtc gac ccc cgg acg ttg aac ccc acg ctg gat gat	336
Val Phe Cys Asp Val Asp Pro Arg Thr Leu Asn Pro Thr Leu Asp Asp	
100 105 110	
gtg gcg agg gcc atc acg ccg gcg acc aag gcc gta ttg ctg ctc cac	384
Val Ala Arg Ala Ile Thr Pro Ala Thr Lys Ala Val Leu Leu Leu His	
115 120 125	
tat gga gga tcg ccg gga gaa gtc acc gcg atc gcc gat ttc tgc cgt	432
Tyr Gly Gly Ser Pro Gly Glu Val Thr Ala Ile Ala Asp Phe Cys Arg	
130 135 140	
gaa aag ggc ctc atg ctc atc gag gac tcc gcc tgc gcg gtg gca tcg	480
Glu Lys Gly Leu Met Leu Ile Glu Asp Ser Ala Cys Ala Val Ala Ser	
145 150 155 160	
tcc gtg cac ggc acc gct tgc gga acc ttt ggt gac ctg gcc acg tgg	528
Ser Val His Gly Thr Ala Cys Gly Thr Phe Gly Asp Leu Ala Thr Trp	
165 170 175	
agt ttc gat gcg atg aag atc ctg gtc acc ggg gat ggg ggc atg ttc	576
Ser Phe Asp Ala Met Lys Ile Leu Val Thr Gly Asp Gly Gly Met Phe	
180 185 190	
tac gcg gcg gat ccg gag ctg gcg cac cgc gca aga cga ctc gcc tac	624
Tyr Ala Ala Asp Pro Glu Leu Ala His Arg Ala Arg Arg Leu Ala Tyr	
195 200 205	



cac ggt ctt gag cag atg agc gga ttc gat tgc gcc aag tct tcc aac	672
His Gly Leu Glu Gln Met Ser Gly Phe Asp Ser Ala Lys Ser Ser Asn	
210 215 220	
cgc tgg tgg gat att cgc gtc gaa gac atc ggc cag cgg ctg atc ggg	720
Arg Trp Trp Asp Ile Arg Val Glu Asp Ile Gly Gln Arg Leu Ile Gly	
225 230 235 240	
aac gac atg acg gca gcg ctt ggc agc gtg cag ctg cgc aaa ctg cca	768
Asn Asp Met Thr Ala Ala Leu Gly Ser Val Gln Leu Arg Lys Leu Pro	
245 250 255	
gaa ttc atc aac agg cgt aga gaa atc gct acg cag tac gac cgg ttg	816
Glu Phe Ile Asn Arg Arg Arg Glu Ile Ala Thr Gln Tyr Asp Arg Leu	
260 265 270	
ctt tcc gat gtg ccg ggt gtc ctc cta ccg ccg acg cta ccg gat ggg	864
Leu Ser Asp Val Pro Gly Val Leu Leu Pro Pro Thr Leu Pro Asp Gly	
275 280 285	
cac gtc tgc tca cac tac ttc tac tgg gtc cag ctg gct ccg gag atc	912
His Val Ser Ser His Tyr Phe Tyr Trp Val Gln Leu Ala Pro Glu Ile	
290 295 300	
cgc gac cag gtg gcg cag caa atg ctg gaa cgc ggc atc tac acg agc	960
Arg Asp Gln Val Ala Gln Gln Met Leu Glu Arg Gly Ile Tyr Thr Ser	
305 310 315 320	
tac cgc tac ccg ccc ctg cac aag gtc ccc atc tac cgc gcg gac tgc	1008
Tyr Arg Tyr Pro Pro Leu His Lys Val Pro Ile Tyr Arg Ala Asp Cys	
325 330 335	
aag ctg cct tct gcg gag cac gcc tgc cgc aga aca ctc ctg cta cca	1056
Lys Leu Pro Ser Ala Glu His Ala Cys Arg Arg Thr Leu Leu Leu Pro	
340 345 350	
ctg cac cca agc ctt gac gac gcc gag gtg cgc acg gtg gct gac gag	1104
Leu His Pro Ser Leu Asp Asp Ala Glu Val Arg Thr Val Ala Asp Glu	
355 360 365	
ttc cag aag gcc gtc gaa cac cac atc agc caa aga tca cca ctc cga	1152
Phe Gln Lys Ala Val Glu His His Ile Ser Gln Arg Ser Pro Leu Arg	
370 375 380	
aag tga	1158
Lys	
385	

&lt;210&gt; 34

&lt;211&gt; 385

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 34

Val Ile Asn Leu His Gln Pro Ile Leu Gly Thr Glu Glu Leu Asp Ala  
 1 5 10 15

Ile Ala Glu Val Phe Ala Ser Asn Trp Ile Gly Leu Gly Pro Arg Thr  
 20 25 30

Arg Thr Phe Glu Ala Glu Phe Ala His His Leu Gly Val Asp Pro Glu  
 35 40 45

Gln Val Val Phe Leu Asn Ser Gly Thr Ala Ala Leu Phe Leu Thr Val  
 50 55 60

Gln Val Leu Asp Leu Gly Pro Gly Asp Asp Val Val Leu Pro Ser Ile  
 65 70 75 80

Ser Phe Val Ala Ala Ala Asn Ala Ile Ala Ser Ser Gly Ala Arg Pro  
 85 90 95

Val Phe Cys Asp Val Asp Pro Arg Thr Leu Asn Pro Thr Leu Asp Asp  
 100 105 110

Val Ala Arg Ala Ile Thr Pro Ala Thr Lys Ala Val Leu Leu Leu His  
 115 120 125

Tyr Gly Gly Ser Pro Gly Glu Val Thr Ala Ile Ala Asp Phe Cys Arg  
 130 135 140

Glu Lys Gly Leu Met Leu Ile Glu Asp Ser Ala Cys Ala Val Ala Ser  
 145 150 155 160

Ser Val His Gly Thr Ala Cys Gly Thr Phe Gly Asp Leu Ala Thr Trp  
 165 170 175

Ser Phe Asp Ala Met Lys Ile Leu Val Thr Gly Asp Gly Gly Met Phe  
 180 185 190

Tyr Ala Ala Asp Pro Glu Leu Ala His Arg Ala Arg Arg Leu Ala Tyr  
 195 200 205

His Gly Leu Glu Gln Met Ser Gly Phe Asp Ser Ala Lys Ser Ser Asn

210	215	220
Arg Trp Trp Asp Ile Arg Val Glu Asp Ile Gly Gln Arg Leu Ile Gly		
225	230	235 240
Asn Asp Met Thr Ala Ala Leu Gly Ser Val Gln Leu Arg Lys Leu Pro		
245	250	255
Glu Phe Ile Asn Arg Arg Arg Glu Ile Ala Thr Gln Tyr Asp Arg Leu		
260	265	270
Leu Ser Asp Val Pro Gly Val Leu Leu Pro Pro Thr Leu Pro Asp Gly		
275	280	285
His Val Ser Ser His Tyr Phe Tyr Trp Val Gln Leu Ala Pro Glu Ile		
290	295	300
Arg Asp Gln Val Ala Gln Gln Met Leu Glu Arg Gly Ile Tyr Thr Ser		
305	310	315 320
Tyr Arg Tyr Pro Pro Leu His Lys Val Pro Ile Tyr Arg Ala Asp Cys		
325	330	335
Lys Leu Pro Ser Ala Glu His Ala Cys Arg Arg Thr Leu Leu Leu Pro		
340	345	350
Leu His Pro Ser Leu Asp Asp Ala Glu Val Arg Thr Val Ala Asp Glu		
355	360	365
Phe Gln Lys Ala Val Glu His His Ile Ser Gln Arg Ser Pro Leu Arg		
370	375	380
Lys		
385		

<210> 35  
 <211> 750  
 <212> DNA  
 <213> Saccharopolyspora spinosa  
  
 <220>  
 <221> CDS  
 <222> (1) .. (747)  
 <223> ORF15; N-Dimethyltransferase  
  
 <400> 35

atg tcg cgc gtg agc gac aca ttc gca gaa acc tcc tcg gta tac agc 48  
 Met Ser Arg Val Ser Asp Thr Phe Ala Glu Thr Ser Ser Val Tyr Ser  
 1 5 10 15

cca gat cat gcc gac atc tac gac gcg atc cac tcc gcg cgt ggc cgg 96  
 Pro Asp His Ala Asp Ile Tyr Asp Ala Ile His Ser Ala Arg Gly Arg  
 20 25 30

gac tgg gca gcc gag gcc ggg gaa gta gtc cag ctc gta cgc acc agg 144  
 Asp Trp Ala Ala Glu Ala Gly Glu Val Val Gln Leu Val Arg Thr Arg  
 35 40 45

ctg ccc gaa gca cag tcc cta ctc gac gtc gcc tgt ggg acc ggg gcg 192  
 Leu Pro Glu Ala Gln Ser Leu Leu Asp Val Ala Cys Gly Thr Gly Ala  
 50 55 60

cac cta gag cga ttc cgt gcc gaa tac gcg aag gtc gcg ggg ctt gaa 240  
 His Leu Glu Arg Phe Arg Ala Glu Tyr Ala Lys Val Ala Gly Leu Glu  
 65 70 75 80

ctg tcc gat gcg atg cgg gag atc gcg atc aga cga gtc cct gag gta 288  
 Leu Ser Asp Ala Met Arg Glu Ile Ala Ile Arg Arg Val Pro Glu Val  
 85 90 95

ccg att cac atc ggt gac atc cgc gat ttc gac ctc ggc gag cca ttc 336  
 Pro Ile His Ile Gly Asp Ile Arg Asp Phe Asp Leu Gly Glu Pro Phe  
 100 105 110

gac gtc atc acc tgc ctg tgc ttt acc gcg gct tac atg cgg acc gtt 384  
 Asp Val Ile Thr Cys Leu Cys Phe Thr Ala Ala Tyr Met Arg Thr Val  
 115 120 125

gac gac ctg cga cgc gtg acg cgg aac atg gcc cgg cac ctg gcc cct 432  
 Asp Asp Leu Arg Arg Val Thr Arg Asn Met Ala Arg His Leu Ala Pro  
 130 135 140

ggt gga gtc gcg gtc atc gaa ccc tgg tgg ttt ccc gac aag ttc atc 480  
 Gly Gly Val Ala Val Ile Glu Pro Trp Trp Phe Pro Asp Lys Phe Ile  
 145 150 155 160

gac ggg ttc gtc acc gga gcc gtc gcg cac cac ggc gag cgg gtg atc 528  
 Asp Gly Phe Val Thr Gly Ala Val Ala His His Gly Glu Arg Val Ile  
 165 170 175

agc cgg cta tcg cac tcg gtc ctg gag ggc cgt acg agc cgg atg acc 576  
 Ser Arg Leu Ser His Ser Val Leu Glu Gly Arg Thr Ser Arg Met Thr  
 180 185 190

gtc cgc tac aca gtc gcc gaa ccc acc ggg atc cgg gac ttc aca gag 624  
 Val Arg Tyr Thr Val Ala Glu Pro Thr Gly Ile Arg Asp Phe Thr Glu  
           195                          200                          205

ttc gaa atc ctc tcg ctg ttc act gag gac gag tac acc gcc gcg ctc 672  
 Phe Glu Ile Leu Ser Leu Phe Thr Glu Asp Glu Tyr Thr Ala Ala Leu  
           210                          215                          220

gaa gac gca ggg atc cgc gcg gaa tac ctt cct gga gca ccg aac ggc 720  
 Glu Asp Ala Gly Ile Arg Ala Glu Tyr Leu Pro Gly Ala Pro Asn Gly  
           225                          230                          235                          240

cga ggc ctg ttc gtc gga atc cgc aac tga 750  
 Arg Gly Leu Phe Val Gly Ile Arg Asn  
                           245

<210> 36

<211> 249

<212> PRT

<213> Saccharopolyspora spinosa

<400> 36

Met Ser Arg Val Ser Asp Thr Phe Ala Glu Thr Ser Ser Val Tyr Ser  
           1                          5                          10                          15

Pro Asp His Ala Asp Ile Tyr Asp Ala Ile His Ser Ala Arg Gly Arg  
                           20                          25                          30

Asp Trp Ala Ala Glu Ala Gly Glu Val Val Gln Leu Val Arg Thr Arg  
                           35                          40                          45

Leu Pro Glu Ala Gln Ser Leu Leu Asp Val Ala Cys Gly Thr Gly Ala  
           50                          55                          60

His Leu Glu Arg Phe Arg Ala Glu Tyr Ala Lys Val Ala Gly Leu Glu  
           65                          70                          75                          80

Leu Ser Asp Ala Met Arg Glu Ile Ala Ile Arg Arg Val Pro Glu Val  
                           85                          90                          95

Pro Ile His Ile Gly Asp Ile Arg Asp Phe Asp Leu Gly Glu Pro Phe  
                           100                          105                          110

Asp Val Ile Thr Cys Leu Cys Phe Thr Ala Ala Tyr Met Arg Thr Val  
           115                          120                          125

Asp Asp Leu Arg Arg Val Thr Arg Asn Met Ala Arg His Leu Ala Pro

130                      135                      140  
 Gly Gly Val Ala Val Ile Glu Pro Trp Trp Phe Pro Asp Lys Phe Ile  
 145                      150                      155                      160  
 Asp Gly Phe Val Thr Gly Ala Val Ala His His Gly Glu Arg Val Ile  
                     165                      170                      175  
 Ser Arg Leu Ser His Ser Val Leu Glu Gly Arg Thr Ser Arg Met Thr  
                     180                      185                      190  
 Val Arg Tyr Thr Val Ala Glu Pro Thr Gly Ile Arg Asp Phe Thr Glu  
                     195                      200                      205  
 Phe Glu Ile Leu Ser Leu Phe Thr Glu Asp Glu Tyr Thr Ala Ala Leu  
                     210                      215                      220  
 Glu Asp Ala Gly Ile Arg Ala Glu Tyr Leu Pro Gly Ala Pro Asn Gly  
 225                      230                      235                      240  
 Arg Gly Leu Phe Val Gly Ile Arg Asn  
                     245

&lt;210&gt; 37

&lt;211&gt; 726

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1) .. (723)

&lt;223&gt; ORF16; 3,4-Reduktase

&lt;400&gt; 37

atg agc gaa cag acg att gca ctg gtc acc ggc gca aac aag gga atc    48  
 Met Ser Glu Gln Thr Ile Ala Leu Val Thr Gly Ala Asn Lys Gly Ile  
   1                      5                      10                      15

gga tac gag atc gcg gcc ggg ctc ggc gcg ctg ggg tgg agc gtc gga    96  
 Gly Tyr Glu Ile Ala Ala Gly Leu Gly Ala Leu Gly Trp Ser Val Gly  
                     20                      25                      30

atc ggg gca cgg gac cac cag cgc ggg gag gat gcc gtg gcg aaa ttg    144  
 Ile Gly Ala Arg Asp His Gln Arg Gly Glu Asp Ala Val Ala Lys Leu  
                     35                      40                      45

cgt gcg gac ggc gtc gat gcg ttc gcg gta tcc ctg gac gtg aca gac	192
Arg Ala Asp Gly Val Asp Ala Phe Ala Val Ser Leu Asp Val Thr Asp	
50 55 60	
gac gcg agc gtc gcg gct gct gcg gct ctg ctc gag gag cgc gcc ggc	240
Asp Ala Ser Val Ala Ala Ala Ala Ala Leu Leu Glu Glu Arg Ala Gly	
65 70 75 80	
cgg ctc gat gtg ctg gtt aat aac gcc ggc atc gcc ggg gca tgg ccg	288
Arg Leu Asp Val Leu Val Asn Asn Ala Gly Ile Ala Gly Ala Trp Pro	
85 90 95	
gag gag ccc tcg acc gtc aca ccg gcg agc ctc cgg gcg gtg gtg gag	336
Glu Glu Pro Ser Thr Val Thr Pro Ala Ser Leu Arg Ala Val Val Glu	
100 105 110	
acc aac gtg atc ggc gtc gtt cgg gtt acc aac gct atg ctg ccg ttg	384
Thr Asn Val Ile Gly Val Val Arg Val Thr Asn Ala Met Leu Pro Leu	
115 120 125	
cta cgc cgc tcc gag cgc ccg cgg atc gtc aac cag tcc agc cac gtc	432
Leu Arg Arg Ser Glu Arg Pro Arg Ile Val Asn Gln Ser Ser His Val	
130 135 140	
gct tcc ctg acc ttg caa acc acg ccg ggc gtc gac ctc ggc ggg atc	480
Ala Ser Leu Thr Leu Gln Thr Thr Pro Gly Val Asp Leu Gly Gly Ile	
145 150 155 160	
agc gga gcc tac tca ccg tcg aag acg ttc ctc aac gcg atc acc atc	528
Ser Gly Ala Tyr Ser Pro Ser Lys Thr Phe Leu Asn Ala Ile Thr Ile	
165 170 175	
cag tac gcc aag gaa ctc agc gat acc aac atc aaa atc aac aac gcc	576
Gln Tyr Ala Lys Glu Leu Ser Asp Thr Asn Ile Lys Ile Asn Asn Ala	
180 185 190	
tgc ccc ggc tac gtc gcg acc gac ctt aac ggc ttc cac gga acc agc	624
Cys Pro Gly Tyr Val Ala Thr Asp Leu Asn Gly Phe His Gly Thr Ser	
195 200 205	
acg ccg gca gac ggt gcc agg atc gcc att cgg ctc gcc acg ctg cca	672
Thr Pro Ala Asp Gly Ala Arg Ile Ala Ile Arg Leu Ala Thr Leu Pro	
210 215 220	
gac gac ggc ccg acc gga ggc atg ttc gac gac gcc ggg aat gtg ccc	720
Asp Asp Gly Pro Thr Gly Gly Met Phe Asp Asp Ala Gly Asn Val Pro	
225 230 235 240	

tgg tga  
Trp

726

&lt;210&gt; 38

&lt;211&gt; 241

&lt;212&gt; PRT

<213> *Saccharopolyspora spinosa*

&lt;400&gt; 38

Met Ser Glu Gln Thr Ile Ala Leu Val Thr Gly Ala Asn Lys Gly Ile

1

5

10

15

Gly Tyr Glu Ile Ala Ala Gly Leu Gly Ala Leu Gly Trp Ser Val Gly

20

25

30

Ile Gly Ala Arg Asp His Gln Arg Gly Glu Asp Ala Val Ala Lys Leu

35

40

45

Arg Ala Asp Gly Val Asp Ala Phe Ala Val Ser Leu Asp Val Thr Asp

50

55

60

Asp Ala Ser Val Ala Ala Ala Ala Ala Leu Leu Glu Glu Arg Ala Gly

65

70

75

80

Arg Leu Asp Val Leu Val Asn Asn Ala Gly Ile Ala Gly Ala Trp Pro

85

90

95

Glu Glu Pro Ser Thr Val Thr Pro Ala Ser Leu Arg Ala Val Val Glu

100

105

110

Thr Asn Val Ile Gly Val Val Arg Val Thr Asn Ala Met Leu Pro Leu

115

120

125

Leu Arg Arg Ser Glu Arg Pro Arg Ile Val Asn Gln Ser Ser His Val

130

135

140

Ala Ser Leu Thr Leu Gln Thr Thr Pro Gly Val Asp Leu Gly Gly Ile

145

150

155

160

Ser Gly Ala Tyr Ser Pro Ser Lys Thr Phe Leu Asn Ala Ile Thr Ile

165

170

175

Gln Tyr Ala Lys Glu Leu Ser Asp Thr Asn Ile Lys Ile Asn Asn Ala

180

185

190

Cys Pro Gly Tyr Val Ala Thr Asp Leu Asn Gly Phe His Gly Thr Ser

195

200

205



Thr Pro Ala Asp Gly Ala Arg Ile Ala Ile Arg Leu Ala Thr Leu Pro  
 210 215 220

Asp Asp Gly Pro Thr Gly Gly Met Phe Asp Asp Ala Gly Asn Val Pro  
 225 230 235 240

Trp

<210> 39

<211> 837

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1)..(834)

<223> ORF17; Transkriptions-Regulator

<400> 39

atg gag acg cgg gag ttg cgg tac ttc gtt gca gtc gcc gag gag ttg 48  
 Met Glu Thr Arg Glu Leu Arg Tyr Phe Val Ala Val Ala Glu Glu Leu  
 1 5 10 15

cac ttc ggc cgg gcc gcc cag cgc ctg ggc atc gcc cag ccg ccg ctg 96  
 His Phe Gly Arg Ala Ala Gln Arg Leu Gly Ile Ala Gln Pro Pro Leu  
 20 25 30

tcg cgg acg atc gcc cag ctc gag caa cga ctc gga gtc gtg ttg ctg 144  
 Ser Arg Thr Ile Ala Gln Leu Glu Gln Arg Leu Gly Val Val Leu Leu  
 35 40 45

caa cgc acc agc cgc aaa gtc tgc ctc acc gaa gcc ggg gca atg ctg 192  
 Gln Arg Thr Ser Arg Lys Val Ser Leu Thr Glu Ala Gly Ala Met Leu  
 50 55 60

ctg acc gaa ggc cgg gcg atc ctc ggc gcg ctg gca gca gcc gag cga 240  
 Leu Thr Glu Gly Arg Ala Ile Leu Gly Ala Leu Ala Ala Ala Glu Arg  
 65 70 75 80

cgc acc cag cgt gcc gcg acg agc cag ccc tgc cta gtc ctg gct gcc 288  
 Arg Thr Gln Arg Ala Ala Thr Ser Gln Pro Ser Leu Val Leu Ala Ala  
 85 90 95

aag gcc ggc gcc tcc ggt gag ctg ctg gcg aag ttg ctc gac gcg tac 336

Lys Ala Gly Ala Ser Gly Glu Leu Leu Ala Lys Leu Leu Asp Ala Tyr  
 100 105 110

gcc gcc gag ccg gga gcc gtg gcc gtc gac ctg ctg ctc tgc gaa tcc 384  
 Ala Ala Glu Pro Gly Ala Val Ala Val Asp Leu Leu Leu Cys Glu Ser  
 115 120 125

cag ccc cag aaa acg ctg cat gac ggc cgg gcc gac gtg gcg ctg ttg 432  
 Gln Pro Gln Lys Thr Leu His Asp Gly Arg Ala Asp Val Ala Leu Leu  
 130 135 140

cat caa ccc ttc gac ccg acg gcc gaa ctc gac atc gaa att ctg aac 480  
 His Gln Pro Phe Asp Pro Thr Ala Glu Leu Asp Ile Glu Ile Leu Asn  
 145 150 155 160

acc gag caa caa gtc gcc att ctt ccg acc tcg cat ccg ctt gcc agc 528  
 Thr Glu Gln Gln Val Ala Ile Leu Pro Thr Ser His Pro Leu Ala Ser  
 165 170 175

gag ccc cat gta cgg atg gcg gat gtc agc tca ctg ccg gat ctc ccg 576  
 Glu Pro His Val Arg Met Ala Asp Val Ser Ser Leu Pro Asp Leu Pro  
 180 185 190

ctt gcg cgc tgg ccc ggc ccc gac ggc gtc tat cca gat ggc ccc ggc 624  
 Leu Ala Arg Trp Pro Gly Pro Asp Gly Val Tyr Pro Asp Gly Pro Gly  
 195 200 205

gtg gaa gta cgc aac cag acg caa ctg ttc caa atg atc gca ctc ggc 672  
 Val Glu Val Arg Asn Gln Thr Gln Leu Phe Gln Met Ile Ala Leu Gly  
 210 215 220

cgc act acc gtg gtc atg ccc gaa tcc agt cgc gtc aac ctg ctc gaa 720  
 Arg Thr Thr Val Val Met Pro Glu Ser Ser Arg Val Asn Leu Leu Glu  
 225 230 235 240

ggc ctc gcc gcc gta ccg gtt cta gac gcg ccg gac gtg acg aca gtc 768  
 Gly Leu Ala Ala Val Pro Val Leu Asp Ala Pro Asp Val Thr Thr Val  
 245 250 255

atc gcc tgg ccg ccc cac agc cgc tcc cga gca ctc gcc ggc ttg gtc 816  
 Ile Ala Trp Pro Pro His Ser Arg Ser Arg Ala Leu Ala Gly Leu Val  
 260 265 270

cgc gtg gcc aca ctc ctc taa 837  
 Arg Val Ala Thr Leu Leu  
 275

&lt;210&gt; 40

&lt;211&gt; 278

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 40

Met Glu Thr Arg Glu Leu Arg Tyr Phe Val Ala Val Ala Glu Glu Leu  
 1 5 10 15

His Phe Gly Arg Ala Ala Gln Arg Leu Gly Ile Ala Gln Pro Pro Leu  
 20 25 30

Ser Arg Thr Ile Ala Gln Leu Glu Gln Arg Leu Gly Val Val Leu Leu  
 35 40 45

Gln Arg Thr Ser Arg Lys Val Ser Leu Thr Glu Ala Gly Ala Met Leu  
 50 55 60

Leu Thr Glu Gly Arg Ala Ile Leu Gly Ala Leu Ala Ala Ala Glu Arg  
 65 70 75 80

Arg Thr Gln Arg Ala Ala Thr Ser Gln Pro Ser Leu Val Leu Ala Ala  
 85 90 95

Lys Ala Gly Ala Ser Gly Glu Leu Leu Ala Lys Leu Leu Asp Ala Tyr  
 100 105 110

Ala Ala Glu Pro Gly Ala Val Ala Val Asp Leu Leu Leu Cys Glu Ser  
 115 120 125

Gln Pro Gln Lys Thr Leu His Asp Gly Arg Ala Asp Val Ala Leu Leu  
 130 135 140

His Gln Pro Phe Asp Pro Thr Ala Glu Leu Asp Ile Glu Ile Leu Asn  
 145 150 155 160

Thr Glu Gln Gln Val Ala Ile Leu Pro Thr Ser His Pro Leu Ala Ser  
 165 170 175

Glu Pro His Val Arg Met Ala Asp Val Ser Ser Leu Pro Asp Leu Pro  
 180 185 190

Leu Ala Arg Trp Pro Gly Pro Asp Gly Val Tyr Pro Asp Gly Pro Gly  
 195 200 205

Val Glu Val Arg Asn Gln Thr Gln Leu Phe Gln Met Ile Ala Leu Gly  
 210 215 220

Arg Thr Thr Val Val Met Pro Glu Ser Ser Arg Val Asn Leu Leu Glu  
 225 230 235 240

Gly Leu Ala Ala Val Pro Val Leu Asp Ala Pro Asp Val Thr Thr Val  
 245 250 255

Ile Ala Trp Pro Pro His Ser Arg Ser Arg Ala Leu Ala Gly Leu Val  
 260 265 270

Arg Val Ala Thr Leu Leu  
 275

<210> 41

<211> 7788

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1) .. (7785)

<223> ORF18; Polyketidsynthase

<400> 41

atg agc gaa gcc. ggg aac ctg ata gcc gtc atc gga ctg tcc tgc cgc 48  
 Met Ser Glu Ala Gly Asn Leu Ile Ala Val Ile Gly Leu Ser Cys Arg  
 1 5 10 15

cta ccc cag gcg cct gac ccg gct tcc ttc tgg cgg ttg ctg cgc acc 96  
 Leu Pro Gln Ala Pro Asp Pro Ala Ser Phe Trp Arg Leu Leu Arg Thr  
 20 25 30

gga acg gac gcc atc acc acg gtc ccg gaa ggg cgg tgg ggc gac ccg 144  
 Gly Thr Asp Ala Ile Thr Thr Val Pro Glu Gly Arg Trp Gly Asp Pro  
 35 40 45

ttg cct ggt cgg gat gcg ccc aag ggc. ccg gaa tgg ggt ggt ttc ctg 192  
 Leu Pro Gly Arg Asp Ala Pro Lys Gly Pro Glu Trp Gly Gly Phe Leu  
 50 55 60

gct gat gtc gac tgc ttc gat ccc gag ttc ttc ggg atc tcg ccg cga 240  
 Ala Asp Val Asp Cys Phe Asp Pro Glu Phe Phe Gly Ile Ser Pro Arg  
 65 70 75 80

gaa gcg gca gcc gtg gat ccc cag cag agg ctg gct ctg gag ctc gcc 288  
 Glu Ala Ala Ala Val Asp Pro Gln Gln Arg Leu Ala Leu Glu Leu Ala  
 85 90 95

tgg gag gca ctc gaa gac gcc ggt atc ccc gcc ggc gag ctg cgc ggt	336
Trp Glu Ala Leu Glu Asp Ala Gly Ile Pro Ala Gly Glu Leu Arg Gly	
100 105 110	
act gcc gcc ggt gtg ttc atg ggg gcg atc tct gac gac tac gcc gcc	384
Thr Ala Ala Gly Val Phe Met Gly Ala Ile Ser Asp Asp Tyr Ala Ala	
115 120 125	
ctg ctg cgc gag agc ccg ccg gaa gtg gct gcg cag tac cgc ctc acc	432
Leu Leu Arg Glu Ser Pro Pro Glu Val Ala Ala Gln Tyr Arg Leu Thr	
130 135 140	
ggc acc cat cga agc ctg atc gcc aac cgc gtg tcc tat gtg ctc ggc	480
Gly Thr His Arg Ser Leu Ile Ala Asn Arg Val Ser Tyr Val Leu Gly	
145 150 155 160	
ctg cgc ggg cca agc ctg acg gtg gat tca ggt cag tcc tcg tcc ctg	528
Leu Arg Gly Pro Ser Leu Thr Val Asp Ser Gly Gln Ser Ser Ser Leu	
165 170 175	
gtc ggc gtg cat ctc gcc agc gag agc ctg cga cgg ggt gag tgc acg	576
Val Gly Val His Leu Ala Ser Glu Ser Leu Arg Arg Gly Glu Cys Thr	
180 185 190	
atc gca ctc gcc ggc ggc gtg aac ctc aac ctg gcc gcc gag agc aac	624
Ile Ala Leu Ala Gly Gly Val Asn Leu Asn Leu Ala Ala Glu Ser Asn	
195 200 205	
agc gct ctg atg gac ttc ggc gcg ctc tcc ccg gac ggt cgc tgc ttc	672
Ser Ala Leu Met Asp Phe Gly Ala Leu Ser Pro Asp Gly Arg Cys Phe	
210 215 220	
acc ttc gat gtg cgg gcg aac ggt tac gtc cgt ggt gag ggc ggc ggc	720
Thr Phe Asp Val Arg Ala Asn Gly Tyr Val Arg Gly Glu Gly Gly Gly	
225 230 235 240	
ctt gtc gtg ctg aag aag gcc gat cag gcg cac gcc gat ggc gac cgg	768
Leu Val Val Leu Lys Lys Ala Asp Gln Ala His Ala Asp Gly Asp Arg	
245 250 255	
atc tac tgc ctc atc cgc ggc agc gcg gtc aac aac gat ggg ggc ggt	816
Ile Tyr Cys Leu Ile Arg Gly Ser Ala Val Asn Asn Asp Gly Gly Gly	
260 265 270	
gcc ggg ctc acc gtt ccg gcg gcg gac gcc cag gcg gag ctg ctg cgc	864
Ala Gly Leu Thr Val Pro Ala Ala Asp Ala Gln Ala Glu Leu Leu Arg	
275 280 285	

cag gca tac cgg aac gcg ggc gtc gac ccg gcc gcc gtg cag tat gtc	912
Gln Ala Tyr Arg Asn Ala Gly Val Asp Pro Ala Ala Val Gln Tyr Val	
290 295 300	
gag ctc cac ggc agc gcg acc agg gtc ggg gat ccc gtc gaa gca gca	960
Glu Leu His Gly Ser Ala Thr Arg Val Gly Asp Pro Val Glu Ala Ala	
305 310 315 320	
gcc ctc gga gct gtc ctg ggg gcg gcg aga cgg ccc ggc gac gag ctg	1008
Ala Leu Gly Ala Val Leu Gly Ala Ala Arg Arg Pro Gly Asp Glu Leu	
325 330 335	
cgt gtg ggg tcg gcg aag acc aac gtc ggc cat ctg gaa gca gcg gcg	1056
Arg Val Gly Ser Ala Lys Thr Asn Val Gly His Leu Glu Ala Ala Ala	
340 345 350	
ggc gtc acc ggg ttg ctg aag acc gca ctc agc atc tgg cac cgc gaa	1104
Gly Val Thr Gly Leu Leu Lys Thr Ala Leu Ser Ile Trp His Arg Glu	
355 360 365	
ctg ccg ccg agt ctt cat ttc acc gcc ccc aac ccg gaa atc ccg ctg	1152
Leu Pro Pro Ser Leu His Phe Thr Ala Pro Asn Pro Glu Ile Pro Leu	
370 375 380	
gac gaa ttg aac cta cgc gtc cag cgt gat ctg ccg ccg tgg ccg gag	1200
Asp Glu Leu Asn Leu Arg Val Gln Arg Asp Leu Arg Pro Trp Pro Glu	
385 390 395 400	
agc gag ggg ccg ctg ctg gcc ggc gtc agc gcc ttc gga atg gga ggc	1248
Ser Glu Gly Pro Leu Leu Ala Gly Val Ser Ala Phe Gly Met Gly Gly	
405 410 415	
acg aac tgc cac ctg gtg ctc tcc ggc acg tcc ccg gtg gag cga ccg	1296
Thr Asn Cys His Leu Val Leu Ser Gly Thr Ser Arg Val Glu Arg Arg	
420 425 430	
cgc agt gga ccc gct gag gcg acc atg ccg tgg gtc ttg tcg gcc aga	1344
Arg Ser Gly Pro Ala Glu Ala Thr Met Pro Trp Val Leu Ser Ala Arg	
435 440 445	
aca ccg gtc gca ttg cgt gcg cag gcg gcg cgc ttg cac acg cac ctc	1392
Thr Pro Val Ala Leu Arg Ala Gln Ala Ala Arg Leu His Thr His Leu	
450 455 460	
aat acg gcc ggt caa agt ccg ttg gac gtc gcc tac tca ctg gcg acc	1440
Asn Thr Ala Gly Gln Ser Pro Leu Asp Val Ala Tyr Ser Leu Ala Thr	
465 470 475 480	

act cga tcc gcg ctg ccg cac cgg gcc gcg ctg gtc gcg gac gac gaa	1488
Thr Arg Ser Ala Leu Pro His Arg Ala Ala Leu Val Ala Asp Asp Glu	
485 490 495	
ccg aaa ctg ctc gcc ggg ttg aag gcc ctc gct gac ggc gac gac gcg	1536
Pro Lys Leu Leu Ala Gly Leu Lys Ala Leu Ala Asp Gly Asp Asp Ala	
500 505 510	
ccc acg ctg tgc cac ggc gcg act tcc ggc gag cgg gca gcg gtc ttc	1584
Pro Thr Leu Cys His Gly Ala Thr Ser Gly Glu Arg Ala Ala Val Phe	
515 520 525	
gtc ttt ccc gga cag ggc agc cag tgg atc ggg atg ggt agg cag ctg	1632
Val Phe Pro Gly Gln Gly Ser Gln Trp Ile Gly Met Gly Arg Gln Leu	
530 535 540	
ctc gaa acc tcc gag gtt ttc gcg gcg tcg atg tcg gac tgc gcc gac	1680
Leu Glu Thr Ser Glu Val Phe Ala Ala Ser Met Ser Asp Cys Ala Asp	
545 550 555 560	
gca ttg gcg ccg cac ctg gat tgg tcc ctg ctg gat gtg ctg cgc aac	1728
Ala Leu Ala Pro His Leu Asp Trp Ser Leu Leu Asp Val Leu Arg Asn	
565 570 575	
gcg gcc ggc gct gcg cac ctt gac cac gac gat gtc gtc cag ccc gcg	1776
Ala Ala Gly Ala Ala His Leu Asp His Asp Asp Val Val Gln Pro Ala	
580 585 590	
ctg ttc gcc atc atg gtc tcg ctc gcg gag ctc tgg cgt tcg tgg ggc	1824
Leu Phe Ala Ile Met Val Ser Leu Ala Glu Leu Trp Arg Ser Trp Gly	
595 600 605	
gtg cgt ccg gtg gcg gtc gtc ggg cac tcg cag ggg gag atc gcg gcg	1872
Val Arg Pro Val Ala Val Val Gly His Ser Gln Gly Glu Ile Ala Ala	
610 615 620	
gcc tgc gtc gcc ggg gcc ctg tcc gtc cgc gat gcc gcc agg gtg gtg	1920
Ala Cys Val Ala Gly Ala Leu Ser Val Arg Asp Ala Ala Arg Val Val	
625 630 635 640	
gcg gtg cgc agc agg ctt ctg acg gcg ctg gcc ggc agt ggc gcg atg	1968
Ala Val Arg Ser Arg Leu Leu Thr Ala Leu Ala Gly Ser Gly Ala Met	
645 650 655	
gcc tcg ttg cag cat ccc gcc gaa gag gtg cgg caa atc ctg ttg ccc	2016
Ala Ser Leu Gln His Pro Ala Glu Glu Val Arg Gln Ile Leu Leu Pro	
660 665 670	

tgg cgc gat cgg atc ggc gtg gcg ggg gtg aac gga ccg tcg tcg acc	2064
Trp Arg Asp Arg Ile Gly Val Ala Gly Val Asn Gly Pro Ser Ser Thr	
675 680 685	
ctg gtg tca ggg gac cgg gag gcg atg gcg gaa ctg ctg gcc gag tgc	2112
Leu Val Ser Gly Asp Arg Glu Ala Met Ala Glu Leu Leu Ala Glu Cys	
690 695 700	
gca gac cga gag ctc cgg atg cgc cgg att ccc gtt gaa tac gcc tcc	2160
Ala Asp Arg Glu Leu Arg Met Arg Arg Ile Pro Val Glu Tyr Ala Ser	
705 710 715 720	
cat tcg cct cac atc gag gtt gtc cgg gat gag ctg ctg ggg ctg ttg	2208
His Ser Pro His Ile Glu Val Val Arg Asp Glu Leu Leu Gly Leu Leu	
725 730 735	
gcg ccg gtc gaa ccc agg acg gga agc atc ccg atc tat tcg acg acg	2256
Ala Pro Val Glu Pro Arg Thr Gly Ser Ile Pro Ile Tyr Ser Thr Thr	
740 745 750	
acc ggg gac ctg ctg gac cgg ccg atg gac gcc gac tac tgg tac cgc	2304
Thr Gly Asp Leu Leu Asp Arg Pro Met Asp Ala Asp Tyr Trp Tyr Arg	
755 760 765	
aac ctt cgt caa ccg gtg ctg ttc gaa gcg gcc gtc gag gcc ctg ttg	2352
Asn Leu Arg Gln Pro Val Leu Phe Glu Ala Ala Val Glu Ala Leu Leu	
770 775 780	
aag cgg ggg tac gac gca ttc atc gag atc agc cca cac ccg gtg ctg	2400
Lys Arg Gly Tyr Asp Ala Phe Ile Glu Ile Ser Pro His Pro Val Leu	
785 790 795 800	
act gcg aac atc cag gaa acc gcc gtg cga gca ggg cgg gag gta gtg	2448
Thr Ala Asn Ile Gln Glu Thr Ala Val Arg Ala Gly Arg Glu Val Val	
805 810 815	
gcg ctc ggg aca ctc cgc cgc ggc gaa ggt ggc atg cgg cag gcg ctg	2496
Ala Leu Gly Thr Leu Arg Arg Gly Glu Gly Gly Met Arg Gln Ala Leu	
820 825 830	
acg tcg ctg gcc aga gca cac gta cac gga gtg gcc gcg gac tgg cac	2544
Thr Ser Leu Ala Arg Ala His Val His Gly Val Ala Ala Asp Trp His	
835 840 845	
gcg gtc ttc gcc ggt acc ggg gcg cag cgg gtc gac ctg ccg acg tac	2592
Ala Val Phe Ala Gly Thr Gly Ala Gln Arg Val Asp Leu Pro Thr Tyr	
850 855 860	



gcc ttt cag cga cag cgc tac tgg ctg gac gcg aag ctt ccc gac gtc 2640  
 Ala Phe Gln Arg Gln Arg Tyr Trp Leu Asp Ala Lys Leu Pro Asp Val  
 865 870 875 880

gcc atg ccc gag agc gac gtg tgg acg gcg ttg cgg gaa aag ctg cgg 2688  
 Ala Met Pro Glu Ser Asp Val Ser Thr Ala Leu Arg Glu Lys Leu Arg  
 885 890 895

tct tcg ccg agg gcg gac gtg gac tcg acg acc ctc acg atg atc cgg 2736  
 Ser Ser Pro Arg Ala Asp Val Asp Ser Thr Thr Leu Thr Met Ile Arg  
 900 905 910

gca cag gca gcc gtg gtc ctc ggc cac tcc gat ccg aaa gag gtg gac 2784  
 Ala Gln Ala Ala Val Val Leu Gly His Ser Asp Pro Lys Glu Val Asp  
 915 920 925

ccg gat cgg acg ttc aag gac ctg ggc ttc gat tcc tcg atg gtg gtc 2832  
 Pro Asp Arg Thr Phe Lys Asp Leu Gly Phe Asp Ser Ser Met Val Val  
 930 935 940

gag ctg tgc gac cgc cta aac gcc gcc aca ggt ctg cga ctc gca ccg 2880  
 Glu Leu Cys Asp Arg Leu Asn Ala Ala Thr Gly Leu Arg Leu Ala Pro  
 945 950 955 960

agc gtc gtt ttc gac tgt cct acg ccg gac aag ctc gcc cgc cag gta 2928  
 Ser Val Val Phe Asp Cys Pro Thr Pro Asp Lys Leu Ala Arg Gln Val  
 965 970 975

cgg acg ttg ttg ttg ggc gag ccg gct ccc atg acg tca cac cgg ccg 2976  
 Arg Thr Leu Leu Leu Gly Glu Pro Ala Pro Met Thr Ser His Arg Pro  
 980 985 990

gac tcc gat gcg gac gag cct atc gcc gtg atc ggg atg ggc tgt cgg 3024  
 Asp Ser Asp Ala Asp Glu Pro Ile Ala Val Ile Gly Met Gly Cys Arg  
 995 1000 1005

ttt ccg ggt ggg gtg tcc tcg ccc gag gag ttg tgg cag ttg gtc gcc 3072  
 Phe Pro Gly Gly Val Ser Ser Pro Glu Glu Leu Trp Gln Leu Val Ala  
 1010 1015 1020

gct ggg cgg gac gtc gtg tcc gag ttc ccg gct gac cga ggt tgg gac 3120  
 Ala Gly Arg Asp Val Val Ser Glu Phe Pro Ala Asp Arg Gly Trp Asp  
 1025 1030 1035 1040

ctg gag cgt gcg ggg aca tcg cac gtg cgc gcc ggc ggg ttc ttg cat 3168  
 Leu Glu Arg Ala Gly Thr Ser His Val Arg Ala Gly Gly Phe Leu His  
 1045 1050 1055

ggc gcc ccg gat ttt gac ccc ggg ttc ttc cgg att tcg ccg cgc gag	3216
Gly Ala Pro Asp Phe Asp Pro Gly Phe Phe Arg Ile Ser Pro Arg Glu	
1060 1065 1070	
gcg ttg gcg atg gat cca cag cag cgg ttg ctg ctg gaa atc gcc tgg	3264
Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu Glu Ile Ala Trp	
1075 1080 1085	
gaa gca gtc gaa cga ggc ggg atc aac ccg cag cac ctg cac gga agt	3312
Glu Ala Val Glu Arg Gly Gly Ile Asn Pro Gln His Leu His Gly Ser	
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Gln Thr Gly Val Phe Val Gly Ala Thr Ser Leu Asp Tyr Gly Pro Arg	
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Leu His Glu Ala Ser Glu Glu Ala Ala Gly Tyr Val Leu Thr Gly Ser	
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Thr Thr Ser Val Ala Ser Gly Arg Val Ala Tyr Ser Phe Gly Phe Glu	
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Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala	
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Leu Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly His Glu Val Leu	
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Ala Val Val Arg Gly Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly	
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Leu Thr Ala Pro Asn Gly Ser Ser Gln Gln Arg Val Ile Ala Gln Ala	
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Leu Ala Ser Ala Gly Leu Ser Val Ser Asp Val Asp Ala Val Glu Ala	
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His Gly Thr Gly Thr Arg Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu	
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atc gcc acc tac ggc cag ggc cgg ctt ccg gaa cgg cca ttg tgg ttg	3984
Ile Ala Thr Tyr Gly Gln Gly Arg Leu Pro Glu Arg Pro Leu Trp Leu	
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Gly Ser Met Lys Ser Asn Ile Gly His Ala Gln Ala Ala Ala Gly Ile	
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Ala Gly Val Met Lys Met Val Met Ala Met Arg His Gly Gln Leu Pro	
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Arg Thr Leu His Val Asp Glu Pro Thr Ser Gly Val Asp Trp Ser Ala	
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Gly Thr Val Gln Leu Leu Thr Glu Asn Thr Pro Trp Pro Gly Ser Gly	
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Arg Val Arg Arg Val Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn	
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Ala His Val Ile Leu Glu Gln Pro Pro Gly Val Pro Ser Gln Ser Ala	
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Gly Pro Gly Ser Gly Ser Val Val Asp Val Pro Val Val Pro Trp Met	
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Val Ser Gly Lys Thr Pro Glu Ala Leu Ser Ala Gln Ala Thr Ala Leu	
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atg acc tat ctg gac gag cga cct gat gtc tcc tcg ctg gat gtt ggg	4416
Met Thr Tyr Leu Asp Glu Arg Pro Asp Val Ser Ser Leu Asp Val Gly	
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Tyr Ser Leu Ala Leu Thr Arg Ser Ala Leu Asp Glu Arg Ala Val Val	
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Leu Gly Ser Asp Arg Glu Thr Leu Leu Cys Gly Val Lys Ala Leu Ser	
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Ala Gly His Glu Ala Ser Gly Leu Val Thr Gly Ser Val Gly Ala Gly	
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Gly Arg Ile Gly Phe Val Phe Ser Gly Gln Gly Gly Gln Trp Leu Gly	
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Met Gly Arg Gly Leu Tyr Arg Ala Phe Pro Val Phe Ala Ala Ala Phe	
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Val Gly Glu Leu Ala Ala Ala Phe Ala Ala Gly Val Val Ser Leu Ser	
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His Val Arg Gly Gly Ala Val Asp Trp Arg Ser Phe Phe Ala Gly Thr	
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Arg Ala Lys Gln Ile Glu Leu Pro Thr Tyr Ala Phe Gln Arg Gln Arg	
1860                      1865                      1870	
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Tyr Trp Leu Asn Ala Leu Arg Glu Ser Ser Ala Gly Asp Met Gly Arg	
1875                      1880                      1885	
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Arg Val Glu Ala Lys Phe Trp Gly Ala Val Glu His Glu Asp Val Glu	
1890                      1895                      1900	
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Ser Leu Ala Arg Val Leu Gly Ile Val Asp Asp Gly Ala Ala Val Asp	
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Gln Val Ala Gly Leu Pro Pro Met Gly Thr Val Phe Gly Thr Trp Leu	
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Val Phe Ala Pro His Gly Trp Ser Ser Glu Pro Glu Val Val Asp Cys	
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 Trp Glu Ala Leu Glu Asp Ala Gly Ile Pro Ala Gly Glu Leu Arg Gly  
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Ile Ala Leu Ala Gly Gly Val Asn Leu Asn Leu Ala Ala Glu Ser Asn  
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Ser Ser Pro Arg Ala Asp Val Asp Ser Thr Thr Leu Thr Met Ile Arg  
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Ala Gln Ala Ala Val Val Leu Gly His Ser Asp Pro Lys Glu Val Asp  
 915 920 925

Pro Asp Arg Thr Phe Lys Asp Leu Gly Phe Asp Ser Ser Met Val Val  
 930 935 940

Glu Leu Cys Asp Arg Leu Asn Ala Ala Thr Gly Leu Arg Leu Ala Pro  
 945 950 955 960

Ser Val Val Phe Asp Cys Pro Thr Pro Asp Lys Leu Ala Arg Gln Val  
 965 970 975  
 Arg Thr Leu Leu Leu Gly Glu Pro Ala Pro Met Thr Ser His Arg Pro  
 980 985 990  
 Asp Ser Asp Ala Asp Glu Pro Ile Ala Val Ile Gly Met Gly Cys Arg  
 995 1000 1005  
 Phe Pro Gly Gly Val Ser Ser Pro Glu Glu Leu Trp Gln Leu Val Ala  
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 Ala Gly Arg Asp Val Val Ser Glu Phe Pro Ala Asp Arg Gly Trp Asp  
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 Leu Glu Arg Ala Gly Thr Ser His Val Arg Ala Gly Gly Phe Leu His  
 1045 1050 1055  
 Gly Ala Pro Asp Phe Asp Pro Gly Phe Phe Arg Ile Ser Pro Arg Glu  
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 Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu Glu Ile Ala Trp  
 1075 1080 1085  
 Glu Ala Val Glu Arg Gly Gly Ile Asn Pro Gln His Leu His Gly Ser  
 1090 1095 1100  
 Gln Thr Gly Val Phe Val Gly Ala Thr Ser Leu Asp Tyr Gly Pro Arg  
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 Thr Thr Ser Val Ala Ser Gly Arg Val Ala Tyr Ser Phe Gly Phe Glu  
 1140 1145 1150  
 Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala  
 1155 1160 1165  
 Leu His Leu Ala Cys Gln Ser Leu Arg Ser Gly Glu Cys Asp Leu Ala  
 1170 1175 1180  
 Leu Ala Gly Gly Val Thr Val Met Ala Thr Pro Gly Met Phe Val Glu  
 1185 1190 1195 1200  
 Phe Ser Arg Gln Arg Gly Leu Ala Pro Asp Gly Arg Cys Lys Ser Phe  
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Ala Glu Ala Ala Asp Gly Thr Gly Trp Ser Glu Gly Ala Gly Leu Val  
 1220 1225 1230  
 Leu Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly His Glu Val Leu  
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 1250 1255 1260  
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 1285 1290 1295  
 His Gly Thr Gly Thr Arg Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu  
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 Ile Ala Thr Tyr Gly Gln Gly Arg Leu Pro Glu Arg Pro Leu Trp Leu  
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 Gly Ser Met Lys Ser Asn Ile Gly His Ala Gln Ala Ala Ala Gly Ile  
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 Ala Gly Val Met Lys Met Val Met Ala Met Arg His Gly Gln Leu Pro  
 1345 1350 1355 1360  
 Arg Thr Leu His Val Asp Glu Pro Thr Ser Gly Val Asp Trp Ser Ala  
 1365 1370 1375  
 Gly Thr Val Gln Leu Leu Thr Glu Asn Thr Pro Trp Pro Gly Ser Gly  
 1380 1385 1390  
 Arg Val Arg Arg Val Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn  
 1395 1400 1405  
 Ala His Val Ile Leu Glu Gln Pro Pro Gly Val Pro Ser Gln Ser Ala  
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 Gly Pro Gly Ser Gly Ser Val Val Asp Val Pro Val Val Pro Trp Met  
 1425 1430 1435 1440  
 Val Ser Gly Lys Thr Pro Glu Ala Leu Ser Ala Gln Ala Thr Ala Leu  
 1445 1450 1455  
 Met Thr Tyr Leu Asp Glu Arg Pro Asp Val Ser Ser Leu Asp Val Gly  
 1460 1465 1470

Tyr Ser Leu Ala Leu Thr Arg Ser Ala Leu Asp Glu Arg Ala Val Val  
 1475 1480 1485

Leu Gly Ser Asp Arg Glu Thr Leu Leu Cys Gly Val Lys Ala Leu Ser  
 1490 1495 1500

Ala Gly His Glu Ala Ser Gly Leu Val Thr Gly Ser Val Gly Ala Gly  
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Gly Arg Ile Gly Phe Val Phe Ser Gly Gln Gly Gly Gln Trp Leu Gly  
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Met Gly Arg Gly Leu Tyr Arg Ala Phe Pro Val Phe Ala Ala Ala Phe  
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Val Arg Glu Val Val Ser Gly Ser Asp Ala Gln Leu Leu Asp Arg Thr  
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Leu Trp Ala Gln Ser Gly Leu Phe Ala Leu Gln Val Gly Leu Leu Lys  
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Leu Leu Asp Ser Trp Gly Val Arg Pro Ser Val Val Leu Gly His Ser  
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Val Gly Glu Leu Ala Ala Ala Phe Ala Ala Gly Val Val Ser Leu Ser  
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Pro Ser Gly Gly Gly Met Leu Ala Val Pro Ala Gly Glu Glu Leu Leu  
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Trp Ser Leu Leu Ala Asp Gln Gly Asp Arg Val Gly Ile Ala Ala Val  
 665 1670 1675 1680

Asn Ala Ala Gly Ser Val Val Leu Ser Gly Asp Arg Asp Val Leu Asp  
 1685 1690 1695

Asp Leu Ala Gly Arg Leu Asp Gly Gln Gly Ile Arg Ser Arg Trp Leu  
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Arg Val Ser His Ala Phe His Ser Tyr Arg Met Asp Pro Met Leu Ala  
 1715 1720 1725



Glu Phe Ala Glu Leu Ala Arg Thr Val Asp Tyr Arg Arg Cys Glu Val  
 1730 1735 1740

Pro Ile Val Ser Thr Leu Thr Gly Asp Leu Asp Asp Ala Gly Arg Met  
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Ser Gly Pro Asp Tyr Trp Val Arg Gln Val Arg Glu Pro Val Arg Phe  
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Ala Asp Gly Val Gln Ala Leu Val Glu His Asp Val Ala Thr Val Val  
 1780 1785 1790

Glu Leu Gly Pro Asp Gly Ala Leu Ser Ala Leu Ile Gln Glu Cys Val  
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Ala Ala Ser Asp His Ala Gly Arg Leu Ser Ala Val Pro Ala Met Arg  
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Arg Asn Gln Asp Glu Ala Gln Lys Val Met Thr Ala Leu Ala His Val  
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His Val Arg Gly Gly Ala Val Asp Trp Arg Ser Phe Phe Ala Gly Thr  
 1845 1850 1855

Arg Ala Lys Gln Ile Glu Leu Pro Thr Tyr Ala Phe Gln Arg Gln Arg  
 1860 1865 1870

Tyr Trp Leu Asn Ala Leu Arg Glu Ser Ser Ala Gly Asp Met Gly Arg  
 1875 1880 1885

Arg Val Glu Ala Lys Phe Trp Gly Ala Val Glu His Glu Asp Val Glu  
 1890 1895 1900

Ser Leu Ala Arg Val Leu Gly Ile Val Asp Asp Gly Ala Ala Val Asp  
 905 1910 1915 1920

Ser Leu Arg Ser Ala Leu Pro Val Leu Ala Gly Trp Gln Arg Thr Arg  
 1925 1930 1935

Thr Thr Glu Ser Ile Met Asp Gln Arg Cys Tyr Arg Ile Gly Trp Arg  
 1940 1945 1950

Gln Val Ala Gly Leu Pro Pro Met Gly Thr Val Phe Gly Thr Trp Leu  
 1955 1960 1965

Val Phe Ala Pro His Gly Trp Ser Ser Glu Pro Glu Val Val Asp Cys  
 1970 1975 1980

Val Thr Ala Leu Arg Ala Arg Gly Ala Ser Val Val Leu Val Glu Ala  
 985 1990 1995 2000  
 Asp Pro Asp Pro Thr Ser Phe Gly Asp Arg Val Arg Thr Leu Cys Ser  
 2005 2010 2015  
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 2020 2025 2030  
 Ser Val Leu Pro Gly Phe Ser Ala Val Ser Arg Gly Phe Ala Leu Thr  
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 Val Glu Leu Val Arg Val Leu Arg Ala Ala Gly Ala Thr Ala Arg Leu  
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 Trp Leu Leu Thr Cys Gly Gly Val Ser Val Gly Asp Val Pro Val Arg  
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 Pro Ala Gln Ala Leu Ala Trp Gly Leu Gly Arg Val Val Gly Leu Glu  
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 2100 2105 2110  
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 Asp Glu Val Ala Ile Arg Pro Asp Gly Met Phe Ala Arg Arg Leu Val  
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 Arg Trp Leu Ala Asp Ala Gly Ala Glu His Val Ala Met Val Ser Arg  
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Thr Ala Val Val His Ala Ala Gly Val Ile Glu Thr Gly Asp Ala Ala  
 2245 2250 2255

Ala Met Ser Leu Ala Asp Phe Asp His Val Leu Ser Ala Lys Val Ala  
 2260 2265 2270

Gly Ala Ala Asn Leu Asp Ala Leu Leu Ala Asp Val Glu Leu Asp Ala  
 2275 2280 2285

Phe Val Leu Phe Ser Ser Val Ser Gly Val Trp Gly Ala Gly Gly His  
 2290 2295 2300

Gly Ala Tyr Ala Ala Ala Asn Ala Tyr Leu Asp Ala Leu Ala Glu Gln  
 305 2310 2315 2320

Arg Arg Ser Arg Gly Leu Val Ala Thr Ala Val Ala Trp Gly Pro Trp  
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Ala Gly Glu Gly Met Ala Ser Gly Glu Thr Gly Asp Gln Leu Arg Arg  
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Tyr Gly Leu Ser Pro Met Ala Pro Gln His Ala Ile Ala Gly Ile Arg  
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Gln Ala Val Glu Gln Asp Glu Ile Ser Leu Val Val Ala Asp Val Asp  
 2370 2375 2380

Trp Ala Arg Phe Ser Ala Gly Leu Leu Ala Ala Arg Pro Arg Pro Leu  
 385 2390 2395 2400

Leu Asn Glu Leu Ala Glu Val Lys Glu Leu Leu Val Asp Ala Gln Pro  
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Glu Ala Gly Val Leu Ala Asp Ala Ser Leu Glu Trp Arg Gln Arg Leu  
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Ser Ala Ala Pro Arg Pro Thr Gln Glu Gln Leu Ile Leu Glu Leu Val  
 2435 2440 2445

Arg Gly Glu Thr Ala Leu Val Leu Gly His Pro Gly Ala Ala Ala Val  
 2450 2455 2460

Ala Ser Glu Arg Ala Phe Lys Asp Ser Gly Phe Asp Ser Gln Ala Ala  
 465 2470 2475 2480

Val Glu Leu Arg Val Arg Leu Asn Arg Ala Thr Gly Leu Gln Leu Pro  
 2485 2490 2495

Ser Thr Ile Ile Phe Ser His Pro Thr Pro Ala Glu Leu Ala Ala Glu  
 2500 2505 2510

Leu Arg Ala Arg Leu Leu Pro Glu Ser Ala Gly Ala Gly Ile Pro Glu  
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Glu Asp Glu Ala Arg Ile Arg Ala Ala Leu Thr Ser Ile Pro Phe Pro  
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Ala Leu Arg Glu Ala Gly Leu Val Ser Pro Leu Leu Ala Leu Ala Gly  
 545 2550 2555 2560

His Pro Val Asp Ser Gly Ile Ser Ser Asp Asp Ala Ala Ala Thr Ser  
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Ile Asp Ala Met Asp Val Ala Gly Leu Val Glu Ala Ala Leu Gly Glu  
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Arg Glu Ser  
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 Ser Leu Lys Glu Asn Glu Arg Leu Arg Arg Gly Arg Asp Arg Phe Ser  
 20 25 30

gcg gag aag gac gat ccc atc gcg atc gtg gcg atg agt tgt cgt tat 144  
 Ala Glu Lys Asp Asp Pro Ile Ala Ile Val Ala Met Ser Cys Arg Tyr  
 35 40 45

ccc ggt cag gtc tcc tcg ccg gag gac ctg tgg caa ctg gct gcc ggc 192  
 Pro Gly Gln Val Ser Ser Pro Glu Asp Leu Trp Gln Leu Ala Ala Gly

50	55	60	
ggt gtg gac gcg atc tcc gaa gtt ccg ggg gat cgc gga tgg gac ctg			240
Gly Val Asp Ala Ile Ser Glu Val Pro Gly Asp Arg Gly Trp Asp Leu			
65	70	75	80
gat ggc gtg ttc gtt ccg gac tcc gat cgt cct ggc acg tcg tat gcc			288
Asp Gly Val Phe Val Pro Asp Ser Asp Arg Pro Gly Thr Ser Tyr Ala			
	85	90	95
tgc gcg ggc ggt ttt ctt cag ggc gtg tcg gag ttc gac gcg ggt ttc			336
Cys Ala Gly Gly Phe Leu Gln Gly Val Ser Glu Phe Asp Ala Gly Phe			
	100	105	110
ttc ggg att tcg ccg cgt gag gcg ctg gcg atg gat ccg cag cag cgg			384
Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg			
	115	120	125
ttg ctg ctg gaa gtc gcg tgg gag gtc ttc gag cgg gct ggg ctg gag			432
Leu Leu Leu Glu Val Ala Trp Glu Val Phe Glu Arg Ala Gly Leu Glu			
	130	135	140
cag cgg tcg aca cgc ggt tcc cgc gtt ggc gtg ttc gtc ggc acc aat			480
Gln Arg Ser Thr Arg Gly Ser Arg Val Gly Val Phe Val Gly Thr Asn			
145	150	155	160
ggc cag gac tac gcg tcg tgg ttg cgg acg ccg ccg cct gcg gtg gca			528
Gly Gln Asp Tyr Ala Ser Trp Leu Arg Thr Pro Pro Pro Ala Val Ala			
	165	170	175
ggt cat gtg ctg acg ggc ggt gcg gca gcg gtt ctt tcg ggc cgg gtt			576
Gly His Val Leu Thr Gly Gly Ala Ala Ala Val Leu Ser Gly Arg Val			
	180	185	190
gcg tat tcg ttc ggg ttc gag ggt cct gcg gtg acg gtg gat acg gcg			624
Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr Ala			
	195	200	205
tgt tcg tcg tcg ttg gtg gcg ttg cac ctg gcg ggg caa gca ctg cgg			672
Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ala Leu Arg			
	210	215	220
gcc ggt gag tgc gac ctt gcc ctt gcc ggt ggc gtc acg gtg atg tcg			720
Ala Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val Met Ser			
225	230	235	240
acg ccg aag gtg ttc ctg gag ttc tcc cgc caa cgg ggt ctc gcg ccg			768
Thr Pro Lys Val Phe Leu Glu Phe Ser Arg Gln Arg Gly Leu Ala Pro			

245	250	255	
gat ggg cgg tgc aag tcg ttc gcg gcg ggt gcg gat ggc act gga tgg			816
Asp Gly Arg Cys Lys Ser Phe Ala Ala Gly Ala Asp Gly Thr Gly Trp			
260	265	270	
ggt gag ggt gcc gga ctg ttg ttg ctg gag cgg ttg tcg gat gcc cgg			864
Gly Glu Gly Ala Gly Leu Leu Leu Leu Glu Arg Leu Ser Asp Ala Arg			
275	280	285	
cgg aat ggg cat gag gtg ctg gcg gtt gtt cgt ggt agt gcg gtg aat			912
Arg Asn Gly His Glu Val Leu Ala Val Val Arg Gly Ser Ala Val Asn			
290	295	300	
cag gac ggt gcg tcg aat ggt ttg acc gcg ccg aat ggt tcg tcg cag			960
Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Ser Ser Gln			
305	310	315	320
cag cgg gtg att acc cag gcg ttg gcg agt gcg ggg ttg tcg gtg tcc			1008
Gln Arg Val Ile Thr Gln Ala Leu Ala Ser Ala Gly Leu Ser Val Ser			
325	330	335	
gat gtg gat gct gtg gag gcg cat ggg acg ggc acg cgg ctt ggt gat			1056
Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly Asp			
340	345	350	
ccg atc gag gcg cag gcg ctg atc gcc acc tac ggc cgt gat cgt gat			1104
Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Arg Asp Arg Asp			
355	360	365	
cct ggc cgg ccg ttg tgg ttg ggg tcg gtc aag tcg aac atc ggt cat			1152
Pro Gly Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly His			
370	375	380	
acg caa gcg gcg gcg ggt gtg gct ggt gtg atc aag atg gtg atg gcg			1200
Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met Ala			
385	390	395	400
atg cgg cac ggg cag ctg cca cgc acg ttg cac gtg gaa tcg ccg tcg			1248
Met Arg His Gly Gln Leu Pro Arg Thr Leu His Val Glu Ser Pro Ser			
405	410	415	
ccg gag gtg gat tgg tcg gcg ggg acg gtt caa ctc ctt acg gag aac			1296
Pro Glu Val Asp Trp Ser Ala Gly Thr Val Gln Leu Leu Thr Glu Asn			
420	425	430	
acg ccc tgg ccc agg agt ggt cgt gtt cgt cgg gtg ggg gtg tcg tcg			1344
Thr Pro Trp Pro Arg Ser Gly Arg Val Arg Arg Val Gly Val Ser Ser			

435	440	445	
ttc ggg atc agt ggt act aac gcg cac gtc atc ctc gaa cag ccc ccg			1392
Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Pro Pro			
450	455	460	
gga gtg ccg agt cag tct gcg ggg ccg ggt tcg ggt tct gtc gtg gat			1440
Gly Val Pro Ser Gln Ser Ala Gly Pro Gly Ser Gly Ser Val Val Asp			
465	470	475	480
gtt ccg gtg gtg ccg tgg atg gtg tcg ggc aaa aca ccc gaa gcg cta			1488
Val Pro Val Val Pro Trp Met Val Ser Gly Lys Thr Pro Glu Ala Leu			
485	490	495	
tcc gcg cag gca acg gcg ttg atg acc tat ctg gac gag cga cct gat			1536
Ser Ala Gln Ala Thr Ala Leu Met Thr Tyr Leu Asp Glu Arg Pro Asp			
500	505	510	
gtc tcc tcg ctg gat gtt ggg tac tcg ctg gcg ttg aca cgg tcg gcg			1584
Val Ser Ser Leu Asp Val Gly Tyr Ser Leu Ala Leu Thr Arg Ser Ala			
515	520	525	
ctg gat gag cga gcg gtg gtg ctg ggg tcg gac cgt gaa acg ttg ttg			1632
Leu Asp Glu Arg Ala Val Val Leu Gly Ser Asp Arg Glu Thr Leu Leu			
530	535	540	
tgc ggt gtg aaa gcg ctg tct gcc ggt cat gag gct tct ggg ttg gtg			1680
Cys Gly Val Lys Ala Leu Ser Ala Gly His Glu Ala Ser Gly Leu Val			
545	550	555	560
acc gga tct gtg ggg gct ggg ggc cgc atc ggg ttt gtg ttt tcc ggt			1728
Thr Gly Ser Val Gly Ala Gly Gly Arg Ile Gly Phe Val Phe Ser Gly			
565	570	575	
cag ggt ggt cag tgg ctg ggg atg ggc cgg ggg ctt tac cgg gct ttt			1776
Gln Gly Gly Gln Trp Leu Gly Met Gly Arg Gly Leu Tyr Arg Ala Phe			
580	585	590	
ccg gtg ttc gct gct gcc ttt gac gaa gct tgt gcc gag ctg gat gca			1824
Pro Val Phe Ala Ala Ala Phe Asp Glu Ala Cys Ala Glu Leu Asp Ala			
595	600	605	
cat ctg ggc cag gaa atc ggg gtt cgg gag gtg gtg tcc ggt tcg gat			1872
His Leu Gly Gln Glu Ile Gly Val Arg Glu Val Val Ser Gly Ser Asp			
610	615	620	
gcg cag ttg ctg gat cgg acg ttg tgg gcg cag tcg ggt ttg ttc gcg			1920
Ala Gln Leu Leu Asp Arg Thr Leu Trp Ala Gln Ser Gly Leu Phe Ala			

625	630	635	640	
ttg cag gtg ggc ttg ctg aag ttg ctg gat tgc tgg ggg gtt cgg ccg				1968
Leu Gln Val Gly Leu Leu Lys Leu Leu Asp Ser Trp Gly Val Arg Pro				
	645	650	655	
agt gtg gtg ttg ggg cat tgc gtg ggc gag ttg gcg gcg gcg ttc gcg				2016
Ser Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Ala Phe Ala				
	660	665	670	
gcg ggt gtg gtg tgc ttg tgc ggt gcg gct cgg ttg gtg gcg ggt cgt				2064
Ala Gly Val Val Ser Leu Ser Gly Ala Ala Arg Leu Val Ala Gly Arg				
	675	680	685	
gcc cgg ttg atg cag gcg ttg ccg tct ggc ggt ggg atg ctg gcg gtg				2112
Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Gly Met Leu Ala Val				
	690	695	700	
cct gct ggt gag gag ctg ttg tgg tgc ttg ttg gcc gat cag ggt gat				2160
Pro Ala Gly Glu Glu Leu Leu Trp Ser Leu Leu Ala Asp Gln Gly Asp				
	705	710	715	720
cgt gtg ggg atc gcc gcg gtc aac gct gcg ggg tgc gtg gtg ctc tct				2208
Arg Val Gly Ile Ala Ala Val Asn Ala Ala Gly Ser Val Val Leu Ser				
	725	730	735	
ggt gat cgg gat gtg ctc gat gac ctt gcc ggt cgg ctg gac ggg caa				2256
Gly Asp Arg Asp Val Leu Asp Asp Leu Ala Gly Arg Leu Asp Gly Gln				
	740	745	750	
ggg atc cgg tgc agg tgg ttg ccg gtg tgc cat gcg ttt cat tgc tat				2304
Gly Ile Arg Ser Arg Trp Leu Arg Val Ser His Ala Phe His Ser Tyr				
	755	760	765	
cgg atg gat ccg atg ctg gcg gag ttc gcc gaa ttg gca cga acc gtg				2352
Arg Met Asp Pro Met Leu Ala Glu Phe Ala Glu Leu Ala Arg Thr Val				
	770	775	780	
gat tac cgg cgt tgt gaa gtg ccg atc gtg tgc acc ttg acc gga gac				2400
Asp Tyr Arg Arg Cys Glu Val Pro Ile Val Ser Thr Leu Thr Gly Asp				
	785	790	795	800
ctc gat gac gct ggc agg atg agc ggg ccc gac tac tgg gtg cgt cag				2448
Leu Asp Asp Ala Gly Arg Met Ser Gly Pro Asp Tyr Trp Val Arg Gln				
	805	810	815	
gtg cga gag ccg gtc cgc ttc gcc gac ggt gtc cag gcg ctg gtc gag				2496
Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Gln Ala Leu Val Glu				



820	825	830	
cac gat gtg gcc act gtt gtc gag ctc ggt ccg gac ggg gcg ttg tcg			2544
His Asp Val Ala Thr Val Val Glu Leu Gly Pro Asp Gly Ala Leu Ser			
835	840	845	
gcg ctg atc cag gaa tgt gtc gcc gca tcc gat cac gcc ggg cgg ctg			2592
Ala Leu Ile Gln Glu Cys Val Ala Ala Ser Asp His Ala Gly Arg Leu			
850	855	860	
agc gcg gtc ccg gcg atg cgc agg aac cag gac gag gcg cag aag gtg			2640
Ser Ala Val Pro Ala Met Arg Arg Asn Gln Asp Glu Ala Gln Lys Val			
865	870	875	880
atg acg gcc ctg gca cac gtc cac gta cgt ggt ggt gcg gtg gac tgg			2688
Met Thr Ala Leu Ala His Val His Val Arg Gly Gly Ala Val Asp Trp			
885	890	895	
cgg tcg ttc ttc gcc ggt acg gga gcg aaa caa atc gag ctg ccc acc			2736
Arg Ser Phe Phe Ala Gly Thr Gly Ala Lys Gln Ile Glu Leu Pro Thr			
900	905	910	
tac gcc ttc caa cga cag cgg tac tgg ctg gtg cca tcg gat tcc ggt			2784
Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Val Pro Ser Asp Ser Gly			
915	920	925	
gat gtg aca ggt gcc ggt ctg gcc ggg gcg gag cat ccg ctg ttg ggt			2832
Asp Val Thr Gly Ala Gly Leu Ala Gly Ala Glu His Pro Leu Leu Gly			
930	935	940	
gct gtg gtg ccg gtc gcg ggt ggt gac gag gtg ttg ctg acc ggc agg			2880
Ala Val Val Pro Val Ala Gly Gly Asp Glu Val Leu Leu Thr Gly Arg			
945	950	955	960
att tcg gtg cgg acg cat ccg tgg ctg gcc gaa cac cgg gtg ctg ggt			2928
Ile Ser Val Arg Thr His Pro Trp Leu Ala Glu His Arg Val Leu Gly			
965	970	975	
gaa gtg atc gtt gcg ggc acc gcg ttg ctg gag atc gcc ttg cac gcg			2976
Glu Val Ile Val Ala Gly Thr Ala Leu Leu Glu Ile Ala Leu His Ala			
980	985	990	
ggg gaa cgt ctt ggt tgt gaa cgg gtg gaa gag ctc acc ctg gaa gca			3024
Gly Glu Arg Leu Gly Cys Glu Arg Val Glu Glu Leu Thr Leu Glu Ala			
995	1000	1005	
ccg ctg gtc ctg ccg gag cgc ggg gcg atc cag gtt cag ctg cga gtg			3072
Pro Leu Val Leu Pro Glu Arg Gly Ala Ile Gln Val Gln Leu Arg Val			

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Gly Ala Pro Glu Asn Ser Gly Arg Arg Pro Met Ala Leu Tyr Ser Arg			
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ccc gaa ggg gcg gcg gag cat gac tgg acg cgg cac gcc acg ggc cgg			3168
Pro Glu Gly Ala Ala Glu His Asp Trp Thr Arg His Ala Thr Gly Arg			
1045	1050	1055	
ttg gcg cca ggc cgc ggc gag gcg gct gga gac ctg gcc gac tgg ccg			3216
Leu Ala Pro Gly Arg Gly Glu Ala Ala Gly Asp Leu Ala Asp Trp Pro			
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gct cct ggc gcg ctg ccg gtc gac ctc gac gaa ttc tat cgg gac ctc			3264
Ala Pro Gly Ala Leu Pro Val Asp Leu Asp Glu Phe Tyr Arg Asp Leu			
1075	1080	1085	
gca gag ctt ggg ctg gag tac ggc ccg atc ttc caa ggg ctc aag gcg			3312
Ala Glu Leu Gly Leu Glu Tyr Gly Pro Ile Phe Gln Gly Leu Lys Ala			
1090	1095	1100	
gcc tgg cgg caa ggg gac gag gtg tac gcc gaa gcc gcg ctg ccg gga			3360
Ala Trp Arg Gln Gly Asp Glu Val Tyr Ala Glu Ala Ala Leu Pro Gly			
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Thr Glu Asp Ser Gly Phe Gly Val His Pro Ala Leu Leu Asp Ala Ala			
1125	1130	1135	
ctg cac gca acg gct gtc cga gac atg gat gac gca cgc ttg ccg ttc			3456
Leu His Ala Thr Ala Val Arg Asp Met Asp Asp Ala Arg Leu Pro Phe			
1140	1145	1150	
cag tgg gaa ggt gtg tcc ctg cac gcc aag gcc gcg ccg gct ttg cgg			3504
Gln Trp Glu Gly Val Ser Leu His Ala Lys Ala Ala Pro Ala Leu Arg			
1155	1160	1165	
gtc cgc gtg gtc ccg gct ggt gac gat gcc aag tcc ctg ctg gtt tgt			3552
Val Arg Val Val Pro Ala Gly Asp Asp Ala Lys Ser Leu Leu Val Cys			
1170	1175	1180	
gat ggc acc ggt cga ccg gtg atc tcg gtg gac cga ctc gta ttg cgg			3600
Asp Gly Thr Gly Arg Pro Val Ile Ser Val Asp Arg Leu Val Leu Arg			
1185	1190	1195	1200
tcg gct gcg gcc cgg cgg acc ggt gcg cgc cga cag gcc cat caa gct			3648
Ser Ala Ala Ala Arg Arg Thr Gly Ala Arg Arg Gln Ala His Gln Ala			

1205	1210	1215	
cgg ttg tac cgg ttg agc tgg cca acg gtt caa ctg ccg aca tcc gct			3696
Arg Leu Tyr Arg Leu Ser Trp Pro Thr Val Gln Leu Pro Thr Ser Ala			
1220	1225	1230	
cag cca ccg tcc tgc gtg ctt ctc ggc acc tca gaa gtg tcc gct gac			3744
Gln Pro Pro Ser Cys Val Leu Leu Gly Thr Ser Glu Val Ser Ala Asp			
1235	1240	1245	
ata cag gtg tat ccg gac ctc cgg tcg ttg acg gct gcg ttg gat gcc			3792
Ile Gln Val Tyr Pro Asp Leu Arg Ser Leu Thr Ala Ala Leu Asp Ala			
1250	1255	1260	
ggt gcc gaa cca ccc ggc gtc gtc atc gca ccc acg ccc ccc ggc ggt			3840
Gly Ala Glu Pro Pro Gly Val Val Ile Ala Pro Thr Pro Pro Gly Gly			
1265	1270	1275	1280
gga cga aca gcg gat gtc cgg gag acg act cgg cat gca ctc gac ctg			3888
Gly Arg Thr Ala Asp Val Arg Glu Thr Thr Arg His Ala Leu Asp Leu			
1285	1290	1295	
gta caa ggc tgg ctt tcc gat cag cga ctc aac gaa tcc cga ttg ctc			3936
Val Gln Gly Trp Leu Ser Asp Gln Arg Leu Asn Glu Ser Arg Leu Leu			
1300	1305	1310	
ctg gtg aca cag gga gca gtg gcc gtg gag ccg ggc gaa ccc gtg acc			3984
Leu Val Thr Gln Gly Ala Val Ala Val Glu Pro Gly Glu Pro Val Thr			
1315	1320	1325	
gat ctg gcg cag gcc gcg ctc tgg gga ctg ctg ccg ggc gaa ccc gtg acc			4032
Asp Leu Ala Gln Ala Ala Leu Trp Gly Leu Leu Arg Ser Thr Gln Thr			
1330	1335	1340	
gaa cac cct gat cgc ttc gtc ctc gtc gat gtg cct gag ccc gcg caa			4080
Glu His Pro Asp Arg Phe Val Leu Val Asp Val Pro Glu Pro Ala Gln			
1345	1350	1355	1360
ctc ctc ccc gcg ctg ccg ggg gtg ctg gcc tgc ggc gaa cct cag ctc			4128
Leu Leu Pro Ala Leu Pro Gly Val Leu Ala Cys Gly Glu Pro Gln Leu			
1365	1370	1375	
gcg ttg cga cgt ggc ggc gct cat gcg ccc aga ctg gct gga ctg ggc			4176
Ala Leu Arg Arg Gly Gly Ala His Ala Pro Arg Leu Ala Gly Leu Gly			
1380	1385	1390	
agc gat gac gtc ctg ccc gtg ccg gac ggc acc ggg tgg cga ttg gag			4224
Ser Asp Asp Val Leu Pro Val Pro Asp Gly Thr Gly Trp Arg Leu Glu			

1395	1400	1405	
gcc acg cgc ccg gga agc ctg gat ggg ttg gca ttg gtg gac gaa ccg			4272
Ala Thr Arg Pro Gly Ser Leu Asp Gly Leu Ala Leu Val Asp Glu Pro			
1410	1415	1420	
acg gcc acg gca ccg ctg ggt gac ggt gag gtc agg att gcg atg cgc			4320
Thr Ala Thr Ala Pro Leu Gly Asp Gly Glu Val Arg Ile Ala Met Arg			
1425	1430	1435	1440
gcg gcc ggg gtg aac ttc cgg gat gcg ctc atc gcg ctc ggt atg tat			4368
Ala Ala Gly Val Asn Phe Arg Asp Ala Leu Ile Ala Leu Gly Met Tyr			
1445	1450	1455	
ccc ggt gtg gca tcg ctg ggc agt gag ggc gcc ggg gtc gtg gtg gag			4416
Pro Gly Val Ala Ser Leu Gly Ser Glu Gly Ala Gly Val Val Val Glu			
1460	1465	1470	
acc ggc ccc ggc gtc acc ggc ctg gca ccc ggc gac cgc gtg atg gga			4464
Thr Gly Pro Gly Val Thr Gly Leu Ala Pro Gly Asp Arg Val Met Gly			
1475	1480	1485	
atg atc ccg aag gcg ttc ggg ccg ctc gcg gtc gcc gac cat cgc atg			4512
Met Ile Pro Lys Ala Phe Gly Pro Leu Ala Val Ala Asp His Arg Met			
1490	1495	1500	
gtg acg agg att ccc gct ggt tgg agc ttc gcg ccg gcc gca tcg gtg			4560
Val Thr Arg Ile Pro Ala Gly Trp Ser Phe Ala Arg Ala Ala Ser Val			
1505	1510	1515	1520
ccg atc gtc ttt ctc acc gcc tac tac gcg ctg gtt gat ctc gcc ggg			4608
Pro Ile Val Phe Leu Thr Ala Tyr Tyr Ala Leu Val Asp Leu Ala Gly			
1525	1530	1535	
ttg aga cca ggg gag tcg ttg ctg gtt cat tcg gcc gcc ggt ggg gtg			4656
Leu Arg Pro Gly Glu Ser Leu Leu Val His Ser Ala Ala Gly Gly Val			
1540	1545	1550	
ggg atg gcc gcg atc caa ctc gcc agg cac ctc ggt gca gag gtg tac			4704
Gly Met Ala Ala Ile Gln Leu Ala Arg His Leu Gly Ala Glu Val Tyr			
1555	1560	1565	
gcc acc gct agc gag gac aag tgg caa gcc gtg gag ctg agc cga gaa			4752
Ala Thr Ala Ser Glu Asp Lys Trp Gln Ala Val Glu Leu Ser Arg Glu			
1570	1575	1580	
cac ctc gct tcg tcg cgg acg tgc gat ttc gag cag cag ttc ctc ggg			4800
His Leu Ala Ser Ser Arg Thr Cys Asp Phe Glu Gln Gln Phe Leu Gly			

1585	1590	1595	1600	
gca acc ggc gga cgc ggc gtc gac gtc gtg ctc aac tcc ctc gcc ggg				4848
Ala Thr Gly Gly Arg Gly Val Asp Val Val Leu Asn Ser Leu Ala Gly				
	1605	1610	1615	
gag ttc gcc gat gcg tct ctg cga atg ctg ccg cgc ggt ggc cgt ttc				4896
Glu Phe Ala Asp Ala Ser Leu Arg Met Leu Pro Arg Gly Gly Arg Phe				
	1620	1625	1630	
ctg gag ttg ggg aag acg gat gtt cgt gac ccc gtc gag gtc gcc gat				4944
Leu Glu Leu Gly Lys Thr Asp Val Arg Asp Pro Val Glu Val Ala Asp				
	1635	1640	1645	
gcg cat ccg ggc gtg tct tac cag gct ttc gat acc gta gag gca ggc				4992
Ala His Pro Gly Val Ser Tyr Gln Ala Phe Asp Thr Val Glu Ala Gly				
	1650	1655	1660	
ccg cag cga atc ggc gag atg ctt cac gag ctg gtg gag ttg ttc gag				5040
Pro Gln Arg Ile Gly Glu Met Leu His Glu Leu Val Glu Leu Phe Glu				
	1665	1670	1675	1680
gga cgc gtg ctg gag ccc ctg cct gtc acg gct tgg gac gtt cgg cag				5088
Gly Arg Val Leu Glu Pro Leu Pro Val Thr Ala Trp Asp Val Arg Gln				
	1685	1690	1695	
gcg ccc gag gcg cta cgg cac ctg agc caa gcg cgg cat gtg gga aag				5136
Ala Pro Glu Ala Leu Arg His Leu Ser Gln Ala Arg His Val Gly Lys				
	1700	1705	1710	
ctg gtg ctc acc atg cct ccg gtg tgg gac gcc gca ggc acg gtt ctg				5184
Leu Val Leu Thr Met Pro Pro Val Trp Asp Ala Ala Gly Thr Val Leu				
	1715	1720	1725	
gtt acc ggc gga acg gga gca ctt ggc gca gag gtc gcc cgg cac ctc				5232
Val Thr Gly Gly Thr Gly Ala Leu Gly Ala Glu Val Ala Arg His Leu				
	1730	1735	1740	
gtg atc gag cgc ggg gtg cga aac ctg gtc ctc gtc agc agg cgc ggt				5280
Val Ile Glu Arg Gly Val Arg Asn Leu Val Leu Val Ser Arg Arg Gly				
	1745	1750	1755	1760
ccc gca gcc agt ggc gct gct gag ctc gtg gcg caa ctg acg gcc tac				5328
Pro Ala Ala Ser Gly Ala Ala Glu Leu Val Ala Gln Leu Thr Ala Tyr				
	1765	1770	1775	
ggg gcc gag gtt tcc ttg cag gct tgc gat gtc gcc gat cgt gag acc				5376
Gly Ala Glu Val Ser Leu Gln Ala Cys Asp Val Ala Asp Arg Glu Thr				

1780	1785	1790	
ttg gcg aag gtg ctt gcc agc atc ccg gac gag cat ccg ttg acc gcc			5424
Leu Ala Lys Val Leu Ala Ser Ile Pro Asp Glu His Pro Leu Thr Ala			
1795	1800	1805	
gtg gtg cac gcg gct ggt gtt ctc gac gac gga gtg tcc gaa tcg ctc			5472
Val Val His Ala Ala Gly Val Leu Asp Asp Gly Val Ser Glu Ser Leu			
1810	1815	1820	
acc gtg gag cgg ctg gac cag gtt ctg cgc ccg aag gtc gat ggc gcg			5520
Thr Val Glu Arg Leu Asp Gln Val Leu Arg Pro Lys Val Asp Gly Ala			
1825	1830	1835	1840
cgg aat ctg ctc gag ctg atc gac ccg gac gtg gcc ctc gtg ttg ttc			5568
Arg Asn Leu Leu Glu Leu Ile Asp Pro Asp Val Ala Leu Val Leu Phe			
1845	1850	1855	
tcg tcg gtg tcg ggt gtg ctc ggc agc ggt ggg cag ggt aac tac gcg			5616
Ser Ser Val Ser Gly Val Leu Gly Ser Gly Gly Gln Gly Asn Tyr Ala			
1860	1865	1870	
gcg gcc aac tcc ttc ctc gac gca ttg gcg cag caa agg cag tcg cgc			5664
Ala Ala Asn Ser Phe Leu Asp Ala Leu Ala Gln Gln Arg Gln Ser Arg			
1875	1880	1885	
ggc cta ccg acg aga tca ttg gcc tgg ggg ccc tgg gcg gaa cat ggc			5712
Gly Leu Pro Thr Arg Ser Leu Ala Trp Gly Pro Trp Ala Glu His Gly			
1890	1895	1900	
atg gcc agc acc ttg cgc gaa gcc gag cag gat cga ttg gcg cga tct			5760
Met Ala Ser Thr Leu Arg Glu Ala Glu Gln Asp Arg Leu Ala Arg Ser			
1905	1910	1915	1920
ggg ttg ctg ccg atc tcg acc gag gag ggg ttg tcc cag ttc gac gcc			5808
Gly Leu Leu Pro Ile Ser Thr Glu Glu Gly Leu Ser Gln Phe Asp Ala			
1925	1930	1935	
gcg tgc ggc ggc gcg cat acc gtg gtg gcg ccg gtt cga ttc agc cgc			5856
Ala Cys Gly Gly Ala His Thr Val Val Ala Pro Val Arg Phe Ser Arg			
1940	1945	1950	
ttg tcc gac ggg aac gcg atc aag ttc tcc gtc ctg caa ggt ttg gtc			5904
Leu Ser Asp Gly Asn Ala Ile Lys Phe Ser Val Leu Gln Gly Leu Val			
1955	1960	1965	
ggg ccg cat cgc gtc aac aaa gcg gcg act gcg gat gat gcc gag agc			5952
Gly Pro His Arg Val Asn Lys Ala Ala Thr Ala Asp Asp Ala Glu Ser			

1970	1975	1980	
ctc cgg aaa cgg ttg gga cgc ttg ccg gat gca gaa caa cat cgg att			6000
Leu Arg Lys Arg Leu Gly Arg Leu Pro Asp Ala Glu Gln His Arg Ile			
1985	1990	1995	2000
ctg ctg gac ctc gtc cgc atg cat gtg gcg gca gtg ctc gga ttc gcc			6048
Leu Leu Asp Leu Val Arg Met His Val Ala Ala Val Leu Gly Phe Ala			
	2005	2010	2015
ggg tct cag gag atc acc gcg gac ggc acg ttc aag gtg ctg ggc ttc			6096
Gly Ser Gln Glu Ile Thr Ala Asp Gly Thr Phe Lys Val Leu Gly Phe			
	2020	2025	2030
gac tcg ttg acc gtg gtc gag ttg cgc aac cgg atc aac ggg gcg acg			6144
Asp Ser Leu Thr Val Val Glu Leu Arg Asn Arg Ile Asn Gly Ala Thr			
	2035	2040	2045
ggg ctg cga ctg ccc gcc acc ctg gtg ttc aac tac ccg acg ccg gat			6192
Gly Leu Arg Leu Pro Ala Thr Leu Val Phe Asn Tyr Pro Thr Pro Asp			
	2050	2055	2060
gcg ctc gcc gcg cac ctc gtc acc gcg ctg tcc gca gac cgc ctg gcc			6240
Ala Leu Ala Ala His Leu Val Thr Ala Leu Ser Ala Asp Arg Leu Ala			
	2065	2070	2075
			2080
ggg aca ttc gag gaa ctc gac agg tgg gcg gcg aac ctg ccc acg ctg			6288
Gly Thr Phe Glu Glu Leu Asp Arg Trp Ala Ala Asn Leu Pro Thr Leu			
	2085	2090	2095
gcc agg gat gag gcc acg cgg gcg cag atc acc acc cgg cta cag gcg			6336
Ala Arg Asp Glu Ala Thr Arg Ala Gln Ile Thr Thr Arg Leu Gln Ala			
	2100	2105	2110
atc ttg cag agc ctg gcg gac gtg tcc ggc gga acc ggc ggc ggc tcc			6384
Ile Leu Gln Ser Leu Ala Asp Val Ser Gly Gly Thr Gly Gly Gly Ser			
	2115	2120	2125
gtg ccg gac cgg ctc aga tcg gcc acg gac gac gag ctt ttc caa ctc			6432
Val Pro Asp Arg Leu Arg Ser Ala Thr Asp Asp Glu Leu Phe Gln Leu			
	2130	2135	2140
ctc gac aac gat ctc gaa ctt ccc tga			6459
Leu Asp Asn Asp Leu Glu Leu Pro			
	2145	2150	

&lt;210&gt; 44

&lt;211&gt; 2152

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 44

Met Thr Val Thr Thr Ser Tyr Glu Glu Val Val Glu Ala Leu Arg Ala

1 5 10 15

Ser Leu Lys Glu Asn Glu Arg Leu Arg Arg Gly Arg Asp Arg Phe Ser

20 25 30

Ala Glu Lys Asp Asp Pro Ile Ala Ile Val Ala Met Ser Cys Arg Tyr

35 40 45

Pro Gly Gln Val Ser Ser Pro Glu Asp Leu Trp Gln Leu Ala Ala Gly

50 55 60

Gly Val Asp Ala Ile Ser Glu Val Pro Gly Asp Arg Gly Trp Asp Leu

65 70 75 80

Asp Gly Val Phe Val Pro Asp Ser Asp Arg Pro Gly Thr Ser Tyr Ala

85 90 95

Cys Ala Gly Gly Phe Leu Gln Gly Val Ser Glu Phe Asp Ala Gly Phe

100 105 110

Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg

115 120 125

Leu Leu Leu Glu Val Ala Trp Glu Val Phe Glu Arg Ala Gly Leu Glu

130 135 140

Gln Arg Ser Thr Arg Gly Ser Arg Val Gly Val Phe Val Gly Thr Asn

145 150 155 160

Gly Gln Asp Tyr Ala Ser Trp Leu Arg Thr Pro Pro Pro Ala Val Ala

165 170 175

Gly His Val Leu Thr Gly Gly Ala Ala Ala Val Leu Ser Gly Arg Val

180 185 190

Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr Ala

195 200 205

Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ala Leu Arg

210 215 220

Ala Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val Met Ser



225	230	235	240
Thr Pro Lys Val Phe Leu Glu Phe Ser Arg Gln Arg Gly Leu Ala Pro	245	250	255
Asp Gly Arg Cys Lys Ser Phe Ala Ala Gly Ala Asp Gly Thr Gly Trp	260	265	270
Gly Glu Gly Ala Gly Leu Leu Leu Leu Glu Arg Leu Ser Asp Ala Arg	275	280	285
Arg Asn Gly His Glu Val Leu Ala Val Val Arg Gly Ser Ala Val Asn	290	295	300
Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Ser Ser Gln	305	310	315 320
Gln Arg Val Ile Thr Gln Ala Leu Ala Ser Ala Gly Leu Ser Val Ser	325	330	335
Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly Asp	340	345	350
Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Arg Asp Arg Asp	355	360	365
Pro Gly Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly His	370	375	380
Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met Ala	385	390	395 400
Met Arg His Gly Gln Leu Pro Arg Thr Leu His Val Glu Ser Pro Ser	405	410	415
Pro Glu Val Asp Trp Ser Ala Gly Thr Val Gln Leu Leu Thr Glu Asn	420	425	430
Thr Pro Trp Pro Arg Ser Gly Arg Val Arg Arg Val Gly Val Ser Ser	435	440	445
Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Pro Pro	450	455	460
Gly Val Pro Ser Gln Ser Ala Gly Pro Gly Ser Gly Ser Val Val Asp	465	470	475 480
Val Pro Val Val Pro Trp Met Val Ser Gly Lys Thr Pro Glu Ala Leu			

485	490	495
Ser Ala Gln Ala Thr Ala Leu Met Thr Tyr Leu Asp Glu Arg Pro Asp 500	505	510
Val Ser Ser Leu Asp Val Gly Tyr Ser Leu Ala Leu Thr Arg Ser Ala 515	520	525
Leu Asp Glu Arg Ala Val Val Leu Gly Ser Asp Arg Glu Thr Leu Leu 530	535	540
Cys Gly Val Lys Ala Leu Ser Ala Gly His Glu Ala Ser Gly Leu Val 545	550	555 560
Thr Gly Ser Val Gly Ala Gly Gly Arg Ile Gly Phe Val Phe Ser Gly 565	570	575
Gln Gly Gly Gln Trp Leu Gly Met Gly Arg Gly Leu Tyr Arg Ala Phe 580	585	590
Pro Val Phe Ala Ala Ala Phe Asp Glu Ala Cys Ala Glu Leu Asp Ala 595	600	605
His Leu Gly Gln Glu Ile Gly Val Arg Glu Val Val Ser Gly Ser Asp 610	615	620
Ala Gln Leu Leu Asp Arg Thr Leu Trp Ala Gln Ser Gly Leu Phe Ala 625	630	635 640
Leu Gln Val Gly Leu Leu Lys Leu Leu Asp Ser Trp Gly Val Arg Pro 645	650	655
Ser Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Ala Phe Ala 660	665	670
Ala Gly Val Val Ser Leu Ser Gly Ala Ala Arg Leu Val Ala Gly Arg 675	680	685
Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Gly Met Leu Ala Val 690	695	700
Pro Ala Gly Glu Glu Leu Leu Trp Ser Leu Leu Ala Asp Gln Gly Asp 705	710	715 720
Arg Val Gly Ile Ala Ala Val Asn Ala Ala Gly Ser Val Val Leu Ser 725	730	735
Gly Asp Arg Asp Val Leu Asp Asp Leu Ala Gly Arg Leu Asp Gly Gln		

740	745	750
Gly Ile Arg Ser Arg Trp Leu Arg Val Ser His Ala Phe His Ser Tyr		
755	760	765
Arg Met Asp Pro Met Leu Ala Glu Phe Ala Glu Leu Ala Arg Thr Val		
770	775	780
Asp Tyr Arg Arg Cys Glu Val Pro Ile Val Ser Thr Leu Thr Gly Asp		
785	790	800
Leu Asp Asp Ala Gly Arg Met Ser Gly Pro Asp Tyr Trp Val Arg Gln		
805	810	815
Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Gln Ala Leu Val Glu		
820	825	830
His Asp Val Ala Thr Val Val Glu Leu Gly Pro Asp Gly Ala Leu Ser		
835	840	845
Ala Leu Ile Gln Glu Cys Val Ala Ala Ser Asp His Ala Gly Arg Leu		
850	855	860
Ser Ala Val Pro Ala Met Arg Arg Asn Gln Asp Glu Ala Gln Lys Val		
865	870	875
Met Thr Ala Leu Ala His Val His Val Arg Gly Gly Ala Val Asp Trp		
885	890	895
Arg Ser Phe Phe Ala Gly Thr Gly Ala Lys Gln Ile Glu Leu Pro Thr		
900	905	910
Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Val Pro Ser Asp Ser Gly		
915	920	925
Asp Val Thr Gly Ala Gly Leu Ala Gly Ala Glu His Pro Leu Leu Gly		
930	935	940
Ala Val Val Pro Val Ala Gly Gly Asp Glu Val Leu Leu Thr Gly Arg		
945	950	955
Ile Ser Val Arg Thr His Pro Trp Leu Ala Glu His Arg Val Leu Gly		
965	970	975
Glu Val Ile Val Ala Gly Thr Ala Leu Leu Glu Ile Ala Leu His Ala		
980	985	990
Gly Glu Arg Leu Gly Cys Glu Arg Val Glu Glu Leu Thr Leu Glu Ala		

995	1000	1005
Pro Leu Val Leu Pro Glu Arg Gly Ala Ile Gln Val Gln Leu Arg Val		
1010	1015	1020
Gly Ala Pro Glu Asn Ser Gly Arg Arg Pro Met Ala Leu Tyr Ser Arg		
025	1030	1035 1040
Pro Glu Gly Ala Ala Glu His Asp Trp Thr Arg His Ala Thr Gly Arg		
1045	1050	1055
Leu Ala Pro Gly Arg Gly Glu Ala Ala Gly Asp Leu Ala Asp Trp Pro		
1060	1065	1070
Ala Pro Gly Ala Leu Pro Val Asp Leu Asp Glu Phe Tyr Arg Asp Leu		
1075	1080	1085
Ala Glu Leu Gly Leu Glu Tyr Gly Pro Ile Phe Gln Gly Leu Lys Ala		
1090	1095	1100
Ala Trp Arg Gln Gly Asp Glu Val Tyr Ala Glu Ala Ala Leu Pro Gly		
105	1110	1115 1120
Thr Glu Asp Ser Gly Phe Gly Val His Pro Ala Leu Leu Asp Ala Ala		
1125	1130	1135
Leu His Ala Thr Ala Val Arg Asp Met Asp Asp Ala Arg Leu Pro Phe		
1140	1145	1150
Gln Trp Glu Gly Val Ser Leu His Ala Lys Ala Ala Pro Ala Leu Arg		
1155	1160	1165
Val Arg Val Val Pro Ala Gly Asp Asp Ala Lys Ser Leu Leu Val Cys		
1170	1175	1180
Asp Gly Thr Gly Arg Pro Val Ile Ser Val Asp Arg Leu Val Leu Arg		
185	1190	1195 1200
Ser Ala Ala Ala Arg Arg Thr Gly Ala Arg Arg Gln Ala His Gln Ala		
1205	1210	1215
Arg Leu Tyr Arg Leu Ser Trp Pro Thr Val Gln Leu Pro Thr Ser Ala		
1220	1225	1230
Gln Pro Pro Ser Cys Val Leu Leu Gly Thr Ser Glu Val Ser Ala Asp		
1235	1240	1245
Ile Gln Val Tyr Pro Asp Leu Arg Ser Leu Thr Ala Ala Leu Asp Ala		

1250	1255	1260
Gly Ala Glu Pro Pro Gly Val Val Ile Ala Pro Thr Pro Pro Gly Gly		
265	1270	1275 1280
Gly Arg Thr Ala Asp Val Arg Glu Thr Thr Arg His Ala Leu Asp Leu		
1285	1290	1295
Val Gln Gly Trp Leu Ser Asp Gln Arg Leu Asn Glu Ser Arg Leu Leu		
1300	1305	1310
Leu Val Thr Gln Gly Ala Val Ala Val Glu Pro Gly Glu Pro Val Thr		
1315	1320	1325
Asp Leu Ala Gln Ala Ala Leu Trp Gly Leu Leu Arg Ser Thr Gln Thr		
1330	1335	1340
Glu His Pro Asp Arg Phe Val Leu Val Asp Val Pro Glu Pro Ala Gln		
345	1350	1355 1360
Leu Leu Pro Ala Leu Pro Gly Val Leu Ala Cys Gly Glu Pro Gln Leu		
1365	1370	1375
Ala Leu Arg Arg Gly Gly Ala His Ala Pro Arg Leu Ala Gly Leu Gly		
1380	1385	1390
Ser Asp Asp Val Leu Pro Val Pro Asp Gly Thr Gly Trp Arg Leu Glu		
1395	1400	1405
Ala Thr Arg Pro Gly Ser Leu Asp Gly Leu Ala Leu Val Asp Glu Pro		
1410	1415	1420
Thr Ala Thr Ala Pro Leu Gly Asp Gly Glu Val Arg Ile Ala Met Arg		
425	1430	1435 1440
Ala Ala Gly Val Asn Phe Arg Asp Ala Leu Ile Ala Leu Gly Met Tyr		
1445	1450	1455
Pro Gly Val Ala Ser Leu Gly Ser Glu Gly Ala Gly Val Val Val Glu		
1460	1465	1470
Thr Gly Pro Gly Val Thr Gly Leu Ala Pro Gly Asp Arg Val Met Gly		
1475	1480	1485
Met Ile Pro Lys Ala Phe Gly Pro Leu Ala Val Ala Asp His Arg Met		
1490	1495	1500
Val Thr Arg Ile Pro Ala Gly Trp Ser Phe Ala Arg Ala Ala Ser Val		

505	1510	1515	1520
Pro Ile Val Phe Leu Thr Ala Tyr Tyr Ala Leu Val Asp Leu Ala Gly	1525	1530	1535
Leu Arg Pro Gly Glu Ser Leu Leu Val His Ser Ala Ala Gly Gly Val	1540	1545	1550
Gly Met Ala Ala Ile Gln Leu Ala Arg His Leu Gly Ala Glu Val Tyr	1555	1560	1565
Ala Thr Ala Ser Glu Asp Lys Trp Gln Ala Val Glu Leu Ser Arg Glu	1570	1575	1580
His Leu Ala Ser Ser Arg Thr Cys Asp Phe Glu Gln Gln Phe Leu Gly	585	1590	1595
Ala Thr Gly Gly Arg Gly Val Asp Val Val Leu Asn Ser Leu Ala Gly	1605	1610	1615
Glu Phe Ala Asp Ala Ser Leu Arg Met Leu Pro Arg Gly Gly Arg Phe	1620	1625	1630
Leu Glu Leu Gly Lys Thr Asp Val Arg Asp Pro Val Glu Val Ala Asp	1635	1640	1645
Ala His Pro Gly Val Ser Tyr Gln Ala Phe Asp Thr Val Glu Ala Gly	1650	1655	1660
Pro Gln Arg Ile Gly Glu Met Leu His Glu Leu Val Glu Leu Phe Glu	665	1670	1675
Gly Arg Val Leu Glu Pro Leu Pro Val Thr Ala Trp Asp Val Arg Gln	1685	1690	1695
Ala Pro Glu Ala Leu Arg His Leu Ser Gln Ala Arg His Val Gly Lys	1700	1705	1710
Leu Val Leu Thr Met Pro Pro Val Trp Asp Ala Ala Gly Thr Val Leu	1715	1720	1725
Val Thr Gly Gly Thr Gly Ala Leu Gly Ala Glu Val Ala Arg His Leu	1730	1735	1740
Val Ile Glu Arg Gly Val Arg Asn Leu Val Leu Val Ser Arg Arg Gly	745	1750	1755
Pro Ala Ala Ser Gly Ala Ala Glu Leu Val Ala Gln Leu Thr Ala Tyr			1760

1765	1770	1775
Gly Ala Glu Val Ser Leu Gln Ala Cys Asp Val Ala Asp Arg Glu Thr		
1780	1785	1790
Leu Ala Lys Val Leu Ala Ser Ile Pro Asp Glu His Pro Leu Thr Ala		
1795	1800	1805
Val Val His Ala Ala Gly Val Leu Asp Asp Gly Val Ser Glu Ser Leu		
1810	1815	1820
Thr Val Glu Arg Leu Asp Gln Val Leu Arg Pro Lys Val Asp Gly Ala		
825	1830	1835 1840
Arg Asn Leu Leu Glu Leu Ile Asp Pro Asp Val Ala Leu Val Leu Phe		
1845	1850	1855
Ser Ser Val Ser Gly Val Leu Gly Ser Gly Gly Gln Gly Asn Tyr Ala		
1860	1865	1870
Ala Ala Asn Ser Phe Leu Asp Ala Leu Ala Gln Gln Arg Gln Ser Arg		
1875	1880	1885
Gly Leu Pro Thr Arg Ser Leu Ala Trp Gly Pro Trp Ala Glu His Gly		
1890	1895	1900
Met Ala Ser Thr Leu Arg Glu Ala Glu Gln Asp Arg Leu Ala Arg Ser		
905	1910	1915 1920
Gly Leu Leu Pro Ile Ser Thr Glu Glu Gly Leu Ser Gln Phe Asp Ala		
1925	1930	1935
Ala Cys Gly Gly Ala His Thr Val Val Ala Pro Val Arg Phe Ser Arg		
1940	1945	1950
Leu Ser Asp Gly Asn Ala Ile Lys Phe Ser Val Leu Gln Gly Leu Val		
1955	1960	1965
Gly Pro His Arg Val Asn Lys Ala Ala Thr Ala Asp Asp Ala Glu Ser		
1970	1975	1980
Leu Arg Lys Arg Leu Gly Arg Leu Pro Asp Ala Glu Gln His Arg Ile		
985	1990	1995 2000
Leu Leu Asp Leu Val Arg Met His Val Ala Ala Val Leu Gly Phe Ala		
2005	2010	2015
Gly Ser Gln Glu Ile Thr Ala Asp Gly Thr Phe Lys Val Leu Gly Phe		

2020	2025	2030
Asp Ser Leu Thr Val Val Glu Leu Arg Asn Arg Ile Asn Gly Ala Thr		
2035	2040	2045
Gly Leu Arg Leu Pro Ala Thr Leu Val Phe Asn Tyr Pro Thr Pro Asp		
2050	2055	2060
Ala Leu Ala Ala His Leu Val Thr Ala Leu Ser Ala Asp Arg Leu Ala		
065	2070	2075 2080
Gly Thr Phe Glu Glu Leu Asp Arg Trp Ala Ala Asn Leu Pro Thr Leu		
2085	2090	2095
Ala Arg Asp Glu Ala Thr Arg Ala Gln Ile Thr Thr Arg Leu Gln Ala		
2100	2105	2110
Ile Leu Gln Ser Leu Ala Asp Val Ser Gly Gly Thr Gly Gly Gly Ser		
2115	2120	2125
Val Pro Asp Arg Leu Arg Ser Ala Thr Asp Asp Glu Leu Phe Gln Leu		
2130	2135	2140
Leu Asp Asn Asp Leu Glu Leu Pro		
145	2150	

&lt;210&gt; 45

&lt;211&gt; 9513

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(9510)

&lt;223&gt; ORF20; Polyketidsynthase

&lt;400&gt; 45

atg tcg aat gaa gag aag ctc cgg gag tac ttg cgg cgt gcg ctc gtg	48
Met Ser Asn Glu Glu Lys Leu Arg Glu Tyr Leu Arg Arg Ala Leu Val	
1 5 10 15	

gat ctg cac cag gcg cgc gag cgg ctg cac gag gcg gag tcg gga gag	96
Asp Leu His Gln Ala Arg Glu Arg Leu His Glu Ala Glu Ser Gly Glu	
20 25 30	

cgg gaa ccc atc gcg atc gtg gcg atg ggc tgc cgg tac ccg ggt ggg	144
---	-----



Arg Glu Pro Ile Ala Ile Val Ala Met Gly Cys Arg Tyr Pro Gly Gly	
35 40 45	
gtg cag gac ccg gaa ggg ctg tgg aaa ctg gtc gcc tcc ggt ggc gac	192
Val Gln Asp Pro Glu Gly Leu Trp Lys Leu Val Ala Ser Gly Gly Asp	
50 55 60	
gcc atc ggt gaa ttc ccc gct gat cgt ggt tgg cac ctc gac gag ctc	240
Ala Ile Gly Glu Phe Pro Ala Asp Arg Gly Trp His Leu Asp Glu Leu	
65 70 75 80	
tac gat ccc gac ccg gat cag ccc gga acc tgc tac acc cgg cac ggc	288
Tyr Asp Pro Asp Pro Asp Gln Pro Gly Thr Cys Tyr Thr Arg His Gly	
85 90 95	
ggc ttc ctc cac gac gcc ggc gag ttc gac gcg gga ttc ttc gac atc	336
Gly Phe Leu His Asp Ala Gly Glu Phe Asp Ala Gly Phe Phe Asp Ile	
100 105 110	
agc ccc cgt gag gcg ctc gcg atg gac ccg cag cag cgg ctg ctg ctg	384
Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu	
115 120 125	
gaa atc tcc tgg gag acc gtc gaa tcc gct ggg atg gac ccg agg tcc	432
Glu Ile Ser Trp Glu Thr Val Glu Ser Ala Gly Met Asp Pro Arg Ser	
130 135 140	
ttg cgg ggg agc cgc acc ggg gtg ttc gcg gga ttg atg tac gag ggc	480
Leu Arg Gly Ser Arg Thr Gly Val Phe Ala Gly Leu Met Tyr Glu Gly	
145 150 155 160	
tat gac acc ggc gcc cac cgg gca gga gaa ggt gtc gaa ggc tat ctc	528
Tyr Asp Thr Gly Ala His Arg Ala Gly Glu Gly Val Glu Gly Tyr Leu	
165 170 175	
gga acc ggc aat gcg gga agc gtc gcc tct ggt cgg gtt gcg tat gcg	576
Gly Thr Gly Asn Ala Gly Ser Val Ala Ser Gly Arg Val Ala Tyr Ala	
180 185 190	
ttc ggg ttc gag ggc cca gcg gtg acg gta gac acg gcg tgc tcg tcg	624
Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser	
195 200 205	
tcg ttg gtg gcg ctg cat ttg gcg tgt cag tcg ttg cgg cag ggc gag	672
Ser Leu Val Ala Leu His Leu Ala Cys Gln Ser Leu Arg Gln Gly Glu	
210 215 220	
tgt gat ctg gcg ctg gcc ggt gga gtg acg gtg atg tcg acg ccg gag	720

Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val Met Ser Thr Pro Glu	
225	230 235 240
agg ttc gtg gag ttc tcc cgt cag cgt ggt ctc gca ccg gat ggg cgg	768
Arg Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala Pro Asp Gly Arg	
	245 250 255
tgt aag tcg ttc gcg gcg gct gcg gat gga acc ggt tgg ggt gag ggt	816
Cys Lys Ser Phe Ala Ala Ala Ala Asp Gly Thr Gly Trp Gly Glu Gly	
	260 265 270
gcc ggt ttg gtg ttg ctg gag cgg ctg tca gac gcc agg cgg aac ggg	864
Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly	
	275 280 285
cat cgg gta ctg gcg gtt gtt cgt ggt agc gcg gtg aat cag gac ggt	912
His Arg Val Leu Ala Val Val Arg Gly Ser Ala Val Asn Gln Asp Gly	
	290 295 300
gcg tcg aac gga ttg acg gcc ccg aac ggg ctg gcc cag gag cgg gtc	960
Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Leu Ala Gln Glu Arg Val	
	305 310 315 320
att cag cag gtg ctc acg agt gcg ggg ctg tcg gcg tcc gat gtg gac	1008
Ile Gln Gln Val Leu Thr Ser Ala Gly Leu Ser Ala Ser Asp Val Asp	
	325 330 335
gct gtg gag gcg cat gga acg ggt acg cgg ctt ggt gat ccg atc gag	1056
Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly Asp Pro Ile Glu	
	340 345 350
gcg cag gct ctg ata gcc gcc tat gga cag gat cgg gac cgg gac cgg	1104
Ala Gln Ala Leu Ile Ala Ala Tyr Gly Gln Asp Arg Asp Arg Asp Arg	
	355 360 365
ccg ctg tgg ttg ggg tcg gtc aag tcc aac atc ggt cat acg cag gcg	1152
Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly His Thr Gln Ala	
	370 375 380
gct gcg ggc gtc gct ggt gtg atc aag atg gtc atg gcg atg cgg cac	1200
Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met Ala Met Arg His	
	385 390 395 400
ggg gag ctg ccg cgc acg ttg cac gtg gac gag ccg aat tcg cac gtg	1248
Gly Glu Leu Pro Arg Thr Leu His Val Asp Glu Pro Asn Ser His Val	
	405 410 415
gac tgg tcg gct ggt gcg gtc cga ctc ctg acc gag aac atc cgc tgg	1296

Asp Trp Ser Ala Gly Ala Val Arg Leu Leu Thr Glu Asn Ile Arg Trp	
420	430
cca ggg acg ggt acg cgc cgc gct gga gtg tcg tcg ttc ggg gta agc	1344
Pro Gly Thr Gly Thr Arg Arg Ala Gly Val Ser Ser Phe Gly Val Ser	
435	445
ggg acc aac gca cac gtc atc ctc gaa cac gac ccg ctc gcc gtg acc	1392
Gly Thr Asn Ala His Val Ile Leu Glu His Asp Pro Leu Ala Val Thr	
450	460
gag aac gag gaa gca gcg cag tcc cca gca cct ggg atc gtg ccc tgg	1440
Glu Asn Glu Glu Ala Ala Gln Ser Pro Ala Pro Gly Ile Val Pro Trp	
465	475
gcg ttg tcc ggg cgg tcg tcg acg gcg ctg cgg gcc cag gcc gaa cgg	1488
Ala Leu Ser Gly Arg Ser Ser Thr Ala Leu Arg Ala Gln Ala Glu Arg	
485	495
ctg cgc gag ctg tgc gag cag acc gat ccc gac ccc gtc gat gtc ggt	1536
Leu Arg Glu Leu Cys Glu Gln Thr Asp Pro Asp Pro Val Asp Val Gly	
500	510
ttc tca ctg gcc gcc acg cgc acg gct tgg gag cac cga gcg gtg gtg	1584
Phe Ser Leu Ala Ala Thr Arg Thr Ala Trp Glu His Arg Ala Val Val	
515	525
ctt ggt cgg gac agc gct acg ttg cgc tcc ggg ctt ggc gtt gtt gcc	1632
Leu Gly Arg Asp Ser Ala Thr Leu Arg Ser Gly Leu Gly Val Val Ala	
530	540
agc ggt gaa cca gcg gtc gat gtc gtt gag ggg agc gtc ctg gac ggc	1680
Ser Gly Glu Pro Ala Val Asp Val Val Glu Gly Ser Val Leu Asp Gly	
545	560
gag gtc gtc ttc gtc ttc ccc ggt cag ggc tgg cag tgg gcc ggt atg	1728
Glu Val Val Phe Val Phe Pro Gly Gln Gly Trp Gln Trp Ala Gly Met	
565	575
gca gtc gac ctg ctg gac gct tcg ccg acg ttc gcg cgc cac atg gac	1776
Ala Val Asp Leu Leu Asp Ala Ser Pro Thr Phe Ala Arg His Met Asp	
580	590
gag tgc gcc acc gcg ctg cgg agg tac gtg gac tgg tcg ttg gtc gac	1824
Glu Cys Ala Thr Ala Leu Arg Arg Tyr Val Asp Trp Ser Leu Val Asp	
595	605
gtg ctg cgc gga gcg gag aac tcc cca ccg ctg gac cgg gtg gac gtg	1872

Val	Leu	Arg	Gly	Ala	Glu	Asn	Ser	Pro	Pro	Leu	Asp	Arg	Val	Asp	Val	
610						615					620					
ctc	cag	ccc	gcg	tcc	ttc	gcg	gtg	atg	gtg	tcg	ctc	gcc	gag	gtg	tgg	1920
Leu	Gln	Pro	Ala	Ser	Phe	Ala	Val	Met	Val	Ser	Leu	Ala	Glu	Val	Trp	
625					630					635					640	
cgt	tcc	tac	ggg	gtg	agg	ccg	gcg	gcc	gtc	gtc	ggc	cac	agt	caa	ggc	1968
Arg	Ser	Tyr	Gly	Val	Arg	Pro	Ala	Ala	Val	Val	Gly	His	Ser	Gln	Gly	
				645					650					655		
gaa	atc	gcc	gcg	gcc	tgc	gca	gcc	ggg	gtg	ctg	ccg	ctg	gag	gat	gcg	2016
Glu	Ile	Ala	Ala	Ala	Cys	Ala	Ala	Gly	Val	Leu	Pro	Leu	Glu	Asp	Ala	
			660					665					670			
gcc	agg	ctt	gtc	gca	ttg	cgc	agc	aga	gcg	ttg	aag	gga	ctt	tcg	ggg	2064
Ala	Arg	Leu	Val	Ala	Leu	Arg	Ser	Arg	Ala	Leu	Lys	Gly	Leu	Ser	Gly	
		675				680						685				
cgg	ggt	ggc	atg	gcg	tcg	ctg	gcc	tgc	cct	gcg	gat	gag	gtc	gcg	gca	2112
Arg	Gly	Gly	Met	Ala	Ser	Leu	Ala	Cys	Pro	Ala	Asp	Glu	Val	Ala	Ala	
	690					695					700					
ttg	ttc	gcg	gga	tcg	ggc	ggc	cgt	ctg	gaa	gtt	gcg	gcg	atc	aac	ggc	2160
Leu	Phe	Ala	Gly	Ser	Gly	Gly	Arg	Leu	Glu	Val	Ala	Ala	Ile	Asn	Gly	
705					710					715					720	
ccg	cga	tcg	gtc	gtg	gtg	tcc	ggc	gat	ctg	gaa	gcg	gtg	gac	gaa	ctg	2208
Pro	Arg	Ser	Val	Val	Val	Ser	Gly	Asp	Leu	Glu	Ala	Val	Asp	Glu	Leu	
			725						730				735			
ctg	gca	gag	tgc	gct	gaa	aag	gac	atg	cgt	gca	cgc	cgt	atc	ccc	gtc	2256
Leu	Ala	Glu	Cys	Ala	Glu	Lys	Asp	Met	Arg	Ala	Arg	Arg	Ile	Pro	Val	
			740					745					750			
gac	tac	gcc	tcg	cat	tca	gcg	cac	gtg	gag	gtg	gtt	cgg	agc	ccg	gtg	2304
Asp	Tyr	Ala	Ser	His	Ser	Ala	His	Val	Glu	Val	Val	Arg	Ser	Pro	Val	
		755					760					765				
ctg	gcg	gcc	gcc	gcc	ggg	gtg	cga	cac	cgg	gac	ggc	cag	gtg	ccg	tgg	2352
Leu	Ala	Ala	Ala	Ala	Gly	Val	Arg	His	Arg	Asp	Gly	Gln	Val	Pro	Trp	
	770					775					780					
tgg	tcg	acg	gtg	atc	ggc	gac	tgg	gtg	gat	ccg	gcc	agg	ctg	gac	ggc	2400
Trp	Ser	Thr	Val	Ile	Gly	Asp	Trp	Val	Asp	Pro	Ala	Arg	Leu	Asp	Gly	
785					790					795				800		
gag	tat	tgg	tat	cgg	aac	ctc	cgg	cag	ccg	gtc	cgg	ttc	gaa	cac	gcc	2448

Glu Tyr Trp Tyr Arg Asn Leu Arg Gln Pro Val Arg Phe Glu His Ala	
805	810
	815
gtg cag ggc ctg gtc gag cgg gga ttc ggc ctg ttc atc gaa atg agt	2496
Val Gln Gly Leu Val Glu Arg Gly Phe Gly Leu Phe Ile Glu Met Ser	
820	825
	830
gcg cat ccg gtg ctg acc acg gcg gtc gag gaa acc ggt gcg gag tcg	2544
Ala His Pro Val Leu Thr Thr Ala Val Glu Glu Thr Gly Ala Glu Ser	
835	840
	845
gag acc gcc gtg gcc gcg gta ggt acc ttg cga cgt gac tcg ggc ggc	2592
Glu Thr Ala Val Ala Ala Val Gly Thr Leu Arg Arg Asp Ser Gly Gly	
850	855
	860
ctc cgg agg ttg ttg cat tcg ctg gcc gag gcg tac gtg cgc ggc gcc	2640
Leu Arg Arg Leu Leu His Ser Leu Ala Glu Ala Tyr Val Arg Gly Ala	
865	870
	875
	880
acc gtg gac tgg gcc gtg gcg ttc ggg ggc gcg ggc cga cgg ctg gac	2688
Thr Val Asp Trp Ala Val Ala Phe Gly Gly Ala Gly Arg Arg Leu Asp	
885	890
	895
ctg ccg acc tac ccg ttc cag cgc cag ccg tac tgg ctg gac aag gga	2736
Leu Pro Thr Tyr Pro Phe Gln Arg Gln Arg Tyr Trp Leu Asp Lys Gly	
900	905
	910
gct gcc tcc gac gag gct cgt gcg gtc tcg gac ccg gcg gcg ggc tgg	2784
Ala Ala Ser Asp Glu Ala Arg Ala Val Ser Asp Pro Ala Ala Gly Trp	
915	920
	925
ttc tgg caa gcc gtg gcg cgc caa gac ctg aaa agc gtg tcc gat gcc	2832
Phe Trp Gln Ala Val Ala Arg Gln Asp Leu Lys Ser Val Ser Asp Ala	
930	935
	940
ctc gat ctc gac gcc gac gca ccg ctg agc gca aca ctt cca gcc ctg	2880
Leu Asp Leu Asp Ala Asp Ala Pro Leu Ser Ala Thr Leu Pro Ala Leu	
945	950
	955
	960
tcc gtc tgg cac cgt cag gaa cga gaa agg gtc ttg gca gac ggt tgg	2928
Ser Val Trp His Arg Gln Glu Arg Glu Arg Val Leu Ala Asp Gly Trp	
965	970
	975
cgg tac cga gtc gac tgg gta cgg gtg gcc ccg cag ccg gtc cgg aga	2976
Arg Tyr Arg Val Asp Trp Val Arg Val Ala Pro Gln Pro Val Arg Arg	
980	985
	990
acg cgg gaa acc tgg ctc ctg gtc gtt ccc ccg ggc ggc atc gag gaa	3024

Thr Arg Glu Thr Trp Leu Leu Val Val Pro Pro Gly Gly Ile Glu Glu	
995 1000 1005	
gcg ctg gtc gaa cgg ctg acg gat gcg ttg aac acg cga ggg atc agc	3072
Ala Leu Val Glu Arg Leu Thr Asp Ala Leu Asn Thr Arg Gly Ile Ser	
1010 1015 1020	
acc ctg cgc ctc gac gtg cca ccg gcg gcg acc agt ggc gaa ctc gca	3120
Thr Leu Arg Leu Asp Val Pro Pro Ala Ala Thr Ser Gly Glu Leu Ala	
1025 1030 1035 1040	
acc gaa ctc cgc gcc gca gcc gac ggt gac ccg gtg aag gca atc ctg	3168
Thr Glu Leu Arg Ala Ala Ala Asp Gly Asp Pro Val Lys Ala Ile Leu	
1045 1050 1055	
tcg ctc acc gcg ttg gac gag cga ccc cac ccc gaa tgc aag gac gtc	3216
Ser Leu Thr Ala Leu Asp Glu Arg Pro His Pro Glu Cys Lys Asp Val	
1060 1065 1070	
ccg agc ggg att gcc ttg ctg ctg aac ctg gtc aag gcg ctc ggt gaa	3264
Pro Ser Gly Ile Ala Leu Leu Leu Asn Leu Val Lys Ala Leu Gly Glu	
1075 1080 1085	
gcc gac ctc aga att cct ctg tgg acc atc acg cgt ggt gcg gtc aag	3312
Ala Asp Leu Arg Ile Pro Leu Trp Thr Ile Thr Arg Gly Ala Val Lys	
1090 1095 1100	
gca ggc ccc gca gat cgg ctg ctg cgc ccg atg cag gcg caa gca tgg	3360
Ala Gly Pro Ala Asp Arg Leu Leu Arg Pro Met Gln Ala Gln Ala Trp	
1105 1110 1115 1120	
ggt ctg ggg cga gta gcc gca ctc gaa cac ccc gag cgc tgg ggt ggg	3408
Gly Leu Gly Arg Val Ala Ala Leu Glu His Pro Glu Arg Trp Gly Gly	
1125 1130 1135	
ctg atc gac ctg ccg gat tcg ctg gac ggc gac gtc ctc acg agg ctg	3456
Leu Ile Asp Leu Pro Asp Ser Leu Asp Gly Asp Val Leu Thr Arg Leu	
1140 1145 1150	
ggc gaa gcg ctc acc aac ggc ttg gcg gaa gac caa ctg gcg att cgc	3504
Gly Glu Ala Leu Thr Asn Gly Leu Ala Glu Asp Gln Leu Ala Ile Arg	
1155 1160 1165	
cag tcg ggc gtg ctg gcc cgg cga ctg gta ccc gcc ccg gcg aat cag	3552
Gln Ser Gly Val Leu Ala Arg Arg Leu Val Pro Ala Pro Ala Asn Gln	
1170 1175 1180	
ccc gct gga cgt aag tgg cgc ccc cga ggg agc gcg ctg atc acg ggc	3600

203

Gly Glu His Leu Arg Arg Arg Gly Ile Arg Pro Met Pro Ala Ala Ser	
1380	1385 1390
gcc atc ctg gct ctg cag gaa gta ctt gac cag gat gag acg tgc gtg	4224
Ala Ile Leu Ala Leu Gln Glu Val Leu Asp Gln Asp Glu Thr Cys Val	
1395	1400 1405
tcg atc gct gat gtg gac tgg gac cga ttc gtt ccc acg ttc gcc gcg	4272
Ser Ile Ala Asp Val Asp Trp Asp Arg Phe Val Pro Thr Phe Ala Ala	
1410	1415 1420
act cgc gcc acc cgg ttg ttc gac gaa gtg ccg gcg gcg aga aag gcg	4320
Thr Arg Ala Thr Arg Leu Phe Asp Glu Val Pro Ala Ala Arg Lys Ala	
1425	1430 1435 1440
atg ccc gcg aat ggg ccg gca gaa cca ggc ggc tcg ccg ttc gcc cgc	4368
Met Pro Ala Asn Gly Pro Ala Glu Pro Gly Gly Ser Pro Phe Ala Arg	
1445	1450 1455
aat ctc gcg gag ctg ccg gaa gcc caa cga cgc cac gaa ctg gtg gat	4416
Asn Leu Ala Glu Leu Pro Glu Ala Gln Arg Arg His Glu Leu Val Asp	
1460	1465 1470
ctg gtg tgc gcc cag gtg gca acc gtg ctc ggg cac ggc agt cgc gag	4464
Leu Val Cys Ala Gln Val Ala Thr Val Leu Gly His Gly Ser Arg Glu	
1475	1480 1485
gaa gtc cag ccc gag cgg gcg ttc cgc gcg ctc ggg ttc gac tcc ctc	4512
Glu Val Gln Pro Glu Arg Ala Phe Arg Ala Leu Gly Phe Asp Ser Leu	
1490	1495 1500
atg gcg gtg gat ctg cgc aat cgt ttg acc acc gcc acc ggg ttg cgc	4560
Met Ala Val Asp Leu Arg Asn Arg Leu Thr Thr Ala Thr Gly Leu Arg	
1505	1510 1515 1520
ctg ccg acc aca acc gtc ttc gac tac ccg aat ccg gcc gcc ttg gcc	4608
Leu Pro Thr Thr Thr Val Phe Asp Tyr Pro Asn Pro Ala Ala Leu Ala	
1525	1530 1535
gct cac ctg ctc gag gag ctg gtg ggt gat gtc gcg tcg gct gcg gtg	4656
Ala His Leu Leu Glu Glu Leu Val Gly Asp Val Ala Ser Ala Ala Val	
1540	1545 1550
acc gct gcc agc gcg ccc gcg agt gac gaa ccg atc gcg atc gtc gcg	4704
Thr Ala Ala Ser Ala Pro Ala Ser Asp Glu Pro Ile Ala Ile Val Ala	
1555	1560 1565
atg agc tgc cgg ttt ccg ggt ggc gcg cac tcg ccg gaa gac ctg tgg	4752



Met Ser Cys Arg Phe Pro Gly Gly Ala His Ser Pro Glu Asp Leu Trp	
1570	1575 1580
cgg ctg gtc gcc gcc ggc acg gag gtg atc ggc gag ttc ccc tcc gac	4800
Arg Leu Val Ala Ala Gly Thr Glu Val Ile Gly Glu Phe Pro Ser Asp	
1585	1590 1595 1600
cgg ggc tgg gat gcg gaa ggc ctt tac gat ccg gat gct tcc agg cct	4848
Arg Gly Trp Asp Ala Glu Gly Leu Tyr Asp Pro Asp Ala Ser Arg Pro	
1605	1610 1615
gga acg acg tat gcg cgg atg gcg gga ttc ctc tac gac gcc ggt gag	4896
Gly Thr Thr Tyr Ala Arg Met Ala Gly Phe Leu Tyr Asp Ala Gly Glu	
1620	1625 1630
ttc gat gcc gac ctg ttc ggc atc agc cca cgt gag gcg ttg gcg atg	4944
Phe Asp Ala Asp Leu Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met	
1635	1640 1645
gat ccg cag cag cgg ttg gtg ctc gaa atc gcc tgg gaa gcc ctc gaa	4992
Asp Pro Gln Gln Arg Leu Val Leu Glu Ile Ala Trp Glu Ala Leu Glu	
1650	1655 1660
cgg gcc gga atc gat ccg ttg tcc ttg aag ggc agt ggg gtc ggc acg	5040
Arg Ala Gly Ile Asp Pro Leu Ser Leu Lys Gly Ser Gly Val Gly Thr	
1665	1670 1675 1680
tac atc ggc gct gga agc cgt ggg tac gcg acg gat gtg cgg cag ttt	5088
Tyr Ile Gly Ala Gly Ser Arg Gly Tyr Ala Thr Asp Val Arg Gln Phe	
1685	1690 1695
ccc gag gag gcg gag ggc tac ctg ctg acg ggt acc tcg gcc agt gtg	5136
Pro Glu Glu Ala Glu Gly Tyr Leu Leu Thr Gly Thr Ser Ala Ser Val	
1700	1705 1710
ctg tcg ggt cgg gtc gcg tat tcg ttt ggt ttc gag ggt cct gcg gtg	5184
Leu Ser Gly Arg Val Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val	
1715	1720 1725
acg gtg gat acg gct tgt tcg tcg tcg ttg gtg gcg ttg cat ctg gcg	5232
Thr Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala	
1730	1735 1740
tgc cag tcg ttg cgt tcg ggc gag tgt gat ctg gcg ttg gcc ggt ggt	5280
Cys Gln Ser Leu Arg Ser Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly	
1745	1750 1755 1760
gtg acc gtg atg tcg acg ccg gag atg ttc gtg gag ttc tcc cgt cag	5328

Val Thr Val Met Ser Thr Pro Glu Met Phe Val Glu Phe Ser Arg Gln	
1765	1770 1775
cgc ggt ttg gcg ccg gat ggg cgg tgc aag tcg ttc gcg gag agc gcg	5376
Arg Gly Leu Ala Pro Asp Gly Arg Cys Lys Ser Phe Ala Glu Ser Ala	
1780	1785 1790
gac ggc acc ggc tgg ggc gaa ggc gcg ggc ctg ttg ttg ctg gag cgg	5424
Asp Gly Thr Gly Trp Gly Glu Gly Ala Gly Leu Leu Leu Leu Glu Arg	
1795	1800 1805
ttg tcg gac gcc cac cgg aat ggg cat cgg gtg ttg gcg gtg gtt cgt	5472
Leu Ser Asp Ala His Arg Asn Gly His Arg Val Leu Ala Val Val Arg	
1810	1815 1820
ggg tca gcg gtg aat cag gac ggc gcc tcg aac gga ctg gcg gcg ccg	5520
Gly Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Ala Ala Pro	
1825	1830 1835 1840
aac ggt ccg tcg cag cag cgg gtg atc aac cag gca ctc gcg aat gcg	5568
Asn Gly Pro Ser Gln Gln Arg Val Ile Asn Gln Ala Leu Ala Asn Ala	
1845	1850 1855
gct ctt tcg gcg tcc gat gtg gat gcg gtg gag gca cat ggc acc ggg	5616
Ala Leu Ser Ala Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly	
1860	1865 1870
acc agg ctg ggt gat ccg atc gag gcg cag gca ttg atc gca acg tat	5664
Thr Arg Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr	
1875	1880 1885
ggg cag gcc cgg gag cgg gat cgg ccc ttg tgg ctg ggg tcg gtc aag	5712
Gly Gln Ala Arg Glu Arg Asp Arg Pro Leu Trp Leu Gly Ser Val Lys	
1890	1895 1900
tcg aac atc ggt cat acg cag gcc gcg gcg ggt gtt gcc ggt gtg atc	5760
Ser Asn Ile Gly His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile	
1905	1910 1915 1920
aag atg gtg atg gcc atg cgg cac ggg cag ctg ccc gcc tcg ctg cac	5808
Lys Met Val Met Ala Met Arg His Gly Gln Leu Pro Ala Ser Leu His	
1925	1930 1935
gcg gat gag ccc acg tcg gag gtc gat tgg tcg tcg ggg gcg gtc cgg	5856
Ala Asp Glu Pro Thr Ser Glu Val Asp Trp Ser Ser Gly Ala Val Arg	
1940	1945 1950
ctc ctc gcc gaa cag gta cct tgg ccg gag tct gac cgt gtt cgt cgg	5904

Leu Leu Ala Glu Gln Val Pro Trp Pro Glu Ser Asp Arg Val Arg Arg	
1955 1960 1965	
gtg ggg gtt tgc tgc ttc ggg atc agc ggc acc aac gca cat gtg atc	5952
Val Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile	
1970 1975 1980	
ctc gaa caa gct acg aat gcg cca gat agt aca gcg gag acg gac aaa	6000
Leu Glu Gln Ala Thr Asn Ala Pro Asp Ser Thr Ala Glu Thr Asp Lys	
1985 1990 1995 2000	
aca gaa tcc gga tct act gtc gat att ccg gtc gtt ccc tgg ttg gtg	6048
Thr Glu Ser Gly Ser Thr Val Asp Ile Pro Val Val Pro Trp Leu Val	
2005 2010 2015	
tcg gga aag acg acg gat tcc ctg cgg gga caa gcc gaa cga gtc ttg	6096
Ser Gly Lys Thr Thr Asp Ser Leu Arg Gly Gln Ala Glu Arg Val Leu	
2020 2025 2030	
tct cag gtc gag tcc cgg ccg gag cag cgt tcg ctg gat gtt gcc tac	6144
Ser Gln Val Glu Ser Arg Pro Glu Gln Arg Ser Leu Asp Val Ala Tyr	
2035 2040 2045	
tcg ctt gct tct ggc cga gcc gcg ctg gat gaa cgc gct gtc gtg ctg	6192
Ser Leu Ala Ser Gly Arg Ala Ala Leu Asp Glu Arg Ala Val Val Leu	
2050 2055 2060	
ggg ggc gac cgc ggt gag ctg gtt gct gga ctg gcg gcg ttg gcc gcc	6240
Gly Ala Asp Arg Gly Glu Leu Val Ala Gly Leu Ala Ala Leu Ala Ala	
2065 2070 2075 2080	
ggg cag gag gct tct ggg gtg atc agc gga act cgt gct tct gct cgg	6288
Gly Gln Glu Ala Ser Gly Val Ile Ser Gly Thr Arg Ala Ser Ala Arg	
2085 2090 2095	
ttc ggg ttc gtg ttc tgc ggg cag ggt ggt cag tgg ttg ggg atg ggc	6336
Phe Gly Phe Val Phe Ser Gly Gln Gly Gly Gln Trp Leu Gly Met Gly	
2100 2105 2110	
aga gcg ctc tac tgc aag ttt ccg gtg ttc gct gct gcg ttt gat gag	6384
Arg Ala Leu Tyr Ser Lys Phe Pro Val Phe Ala Ala Ala Phe Asp Glu	
2115 2120 2125	
gct tgc gcc gag ttg gag gca cat ctg ggg gaa gac cgc cgg gtt cgg	6432
Ala Cys Ala Glu Leu Glu Ala His Leu Gly Glu Asp Arg Arg Val Arg	
2130 2135 2140	
gat gtg gtc ttc ggt tcc gat gcg cag ctg ctg gat cag acg ctg tgg	6480

Asp Val Val Phe Gly Ser Asp Ala Gln Leu Leu Asp Gln Thr Leu Trp	
2145                      2150                      2155                      2160	
gcg cag tcg ggt ctg ttc gcg ctg caa gcc ggc ctc ttg ggg ctg ctg	6528
Ala Gln Ser Gly Leu Phe Ala Leu Gln Ala Gly Leu Leu Gly Leu Leu	
2165                      2170                      2175	
ggt tcg tgg ggc gtt cgg ccg gat gtg gtg atg ggg cat tcg gtc ggg	6576
Gly Ser Trp Gly Val Arg Pro Asp Val Val Met Gly His Ser Val Gly	
2180                      2185                      2190	
gag ttg gcc gcc gcg ttt gcg gct ggc gtg ttg tcg ttg cgg gat gcg	6624
Glu Leu Ala Ala Ala Phe Ala Ala Gly Val Leu Ser Leu Arg Asp Ala	
2195                      2200                      2205	
gct cgg ttg gtg gcc gcg cgc gcc cgg ttg atg caa gcc ctg ccc tct	6672
Ala Arg Leu Val Ala Ala Arg Ala Arg Leu Met Gln Ala Leu Pro Ser	
2210                      2215                      2220	
gac ggc gcg atg ttg gcg gtg gct gct ggt gaa gac ctt gtt cgg cca	6720
Asp Gly Ala Met Leu Ala Val Ala Ala Gly Glu Asp Leu Val Arg Pro	
2225                      2230                      2235                      2240	
ttg ctg gcc ggt cgg gag gag tcc gtg agc gtc gcc gcg ctc aat gcc	6768
Leu Leu Ala Gly Arg Glu Glu Ser Val Ser Val Ala Ala Leu Asn Ala	
2245                      2250                      2255	
ccc ggt tcg gtg gtg ttg tcg ggc gat cgg gag gtg ctg gcc agc atc	6816
Pro Gly Ser Val Val Leu Ser Gly Asp Arg Glu Val Leu Ala Ser Ile	
2260                      2265                      2270	
gtc ggc cgg ctg acc gag ctc cga gtc cgg acg cgg cgc ttg cgg gtc	6864
Val Gly Arg Leu Thr Glu Leu Arg Val Arg Thr Arg Arg Leu Arg Val	
2275                      2280                      2285	
tcc cat gct ttt cat tcg cac cgg atg gac ccg atg ttg ggc gag ttc	6912
Ser His Ala Phe His Ser His Arg Met Asp Pro Met Leu Gly Glu Phe	
2290                      2295                      2300	
gcc cag atc gcc gag tct gcg gag ttc ggt aag cca acg aca ccg ctt	6960
Ala Gln Ile Ala Glu Ser Ala Glu Phe Gly Lys Pro Thr Thr Pro Leu	
2305                      2310                      2315                      2320	
gtg tcg acg ttg acg ggt gag ctc gac aga gcc gcg gaa atg agc aca	7008
Val Ser Thr Leu Thr Gly Glu Leu Asp Arg Ala Ala Glu Met Ser Thr	
2325                      2330                      2335	
cca ggg tat tgg gtg cgc cag gcg cgt gaa ccc gtc cgt ttc gcc gac	7056

Pro Gly Tyr Trp Val Arg Gln Ala Arg Glu Pro Val Arg Phe Ala Asp	
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Gly Val Gln Ala Leu Ala Ala Gln Gly Ile Gly Thr Val Val Glu Leu	
2355	2360 2365
ggc ccg gac gga acg ctg gcg gca ctg gtt cgg gag tgt gcg acc gag	7152
Gly Pro Asp Gly Thr Leu Ala Ala Leu Val Arg Glu Cys Ala Thr Glu	
2370	2375 2380
tcc gat cgg gtt ggg cgg att tcg tcg atc cca ctg atg cgc agg gag	7200
Ser Asp Arg Val Gly Arg Ile Ser Ser Ile Pro Leu Met Arg Arg Glu	
2385	2390 2395 2400
cgg gac gag acc cgt tcg gtg atg aca gcc ctg gcg cat ctc cac acc	7248
Arg Asp Glu Thr Arg Ser Val Met Thr Ala Leu Ala His Leu His Thr	
2405	2410 2415
cgt ggt ggt gag gtg gac tgg cag gcg ttt ttc gcc ggt acc ggc gct	7296
Arg Gly Gly Glu Val Asp Trp Gln Ala Phe Phe Ala Gly Thr Gly Ala	
2420	2425 2430
agg cag ctc gag ttg cca acg tat gcc ttc caa cga cag cac tac tgg	7344
Arg Gln Leu Glu Leu Pro Thr Tyr Ala Phe Gln Arg Gln His Tyr Trp	
2435	2440 2445
atc gag tcc agt gcg cgg cca gca cgc gac cgc gca gac atc ggc gag	7392
Ile Glu Ser Ser Ala Arg Pro Ala Arg Asp Arg Ala Asp Ile Gly Glu	
2450	2455 2460
gtg gcg gaa cag ttc tgg acc gcg gtt gac caa ggc gat ctg gca acg	7440
Val Ala Glu Gln Phe Trp Thr Ala Val Asp Gln Gly Asp Leu Ala Thr	
2465	2470 2475 2480
ttg gtc gcc gct ctg gat ctt ggg gcg gac gac gac aca tgc gca tcg	7488
Leu Val Ala Ala Leu Asp Leu Gly Ala Asp Asp Asp Thr Cys Ala Ser	
2485	2490 2495
ttg agc gat gta ttg ccg gcg ttg tcc tcc tgg cga agc gga ctc cgc	7536
Leu Ser Asp Val Leu Pro Ala Leu Ser Ser Trp Arg Ser Gly Leu Arg	
2500	2505 2510
aac cgt tcg ctc gtc gat tcc tgc cgg tac cga atc agt tgg cat tcc	7584
Asn Arg Ser Leu Val Asp Ser Cys Arg Tyr Arg Ile Ser Trp His Ser	
2515	2520 2525
tct cgg gag gtg ccg gcc ccg aag att tcc ggt acc tgg ctg ttg gtc	7632

Ser Arg Glu Val Pro Ala Pro Lys Ile Ser Gly Thr Trp Leu Leu Val	
2530	2535 2540
gtg ccc ggt gct gcg gat gac gga ttg gtc acg gct ttg acg agt tca	7680
Val Pro Gly Ala Ala Asp Asp Gly Leu Val Thr Ala Leu Thr Ser Ser	
2545	2550 2555 2560
ctg gtc gga ggc ggc gcc gag gtc gtc cgg atc ggc ctg tcc gaa gag	7728
Leu Val Gly Gly Gly Ala Glu Val Val Arg Ile Gly Leu Ser Glu Glu	
2565	2570 2575
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Asp Pro His Arg Glu Asp Val Ala Gln Arg Leu Ala Asn Ala Leu Thr	
2580	2585 2590
gat gcc ggt caa ctc ggt ggc gtg ctt tcg ctg ttg ggg ctc gat gaa	7824
Asp Ala Gly Gln Leu Gly Gly Val Leu Ser Leu Leu Gly Leu Asp Glu	
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Ser Pro Ala Pro Gly Phe Ser Cys Leu Pro Thr Gly Phe Ala Leu Thr	
2610	2615 2620
gtg cag ctt ctg cgg gcc ttg cgg aag gcc gac gtc gag gcg cct ttt	7920
Val Gln Leu Leu Arg Ala Leu Arg Lys Ala Asp Val Glu Ala Pro Phe	
2625	2630 2635 2640
tgg gcg gtg acg cgc ggc ggc gtc gcg ttg gaa gat gta cgc gtg tct	7968
Trp Ala Val Thr Arg Gly Gly Val Ala Leu Glu Asp Val Arg Val Ser	
2645	2650 2655
ccg gag cag gcc ctg gtc tgg ggg ctg ctg cgt gtc gcg gga ctg gag	8016
Pro Glu Gln Ala Leu Val Trp Gly Leu Leu Arg Val Ala Gly Leu Glu	
2660	2665 2670
cac ccg gag ttc tgg ggt ggc ttg atc gac ctg cca tcg gac tgg gac	8064
His Pro Glu Phe Trp Gly Gly Leu Ile Asp Leu Pro Ser Asp Trp Asp	
2675	2680 2685
gac cga ttg ggt gcc cgg ttg gcg ggt gtg ttg gcg gat ggt ggc gag	8112
Asp Arg Leu Gly Ala Arg Leu Ala Gly Val Leu Ala Asp Gly Gly Glu	
2690	2695 2700
gat caa gtc gcc att cgc cgt ggt ggt gtg ttc gtg cgg cgg ttg gaa	8160
Asp Gln Val Ala Ile Arg Arg Gly Gly Val Phe Val Arg Arg Leu Glu	
2705	2710 2715 2720
cgc gct ggt gcg tcg ggt gcc ggg tcg gtg tgg cgt cct cgg ggg acg	8208

Arg Ala Gly Ala Ser Gly Ala Gly Ser Val Trp Arg Pro Arg Gly Thr	2725	2730	2735
gtg ttg gtg acg ggt ggt acg ggc ggt ttg ggg gcg cat gtt gcc cgg	8256		
Val Leu Val Thr Gly Gly Thr Gly Gly Leu Gly Ala His Val Ala Arg	2740	2745	2750
tgg ttg gcc ggt gcc ggg gct gag cac gtg gtg ttg acc agc cgt cga	8304		
Trp Leu Ala Gly Ala Gly Ala Glu His Val Val Leu Thr Ser Arg Arg	2755	2760	2765
gga gcg gac gct ccg ggc gct ggg gaa ttg cgg gcg gag ctg gag gcg	8352		
Gly Ala Asp Ala Pro Gly Ala Gly Glu Leu Arg Ala Glu Leu Glu Ala	2770	2775	2780
ctg ggt gct cgg gtg tcg att gtg ccc tgc gac gtg gct gat cgt gac	8400		
Leu Gly Ala Arg Val Ser Ile Val Pro Cys Asp Val Ala Asp Arg Asp	2785	2790	2795 2800
gca gtg gct gga gtg ttg gca ggg atc ggt ggg gag tgt ccg ctg act	8448		
Ala Val Ala Gly Val Leu Ala Gly Ile Gly Gly Glu Cys Pro Leu Thr	2805	2810	2815
gcg gtg gta cac gcc gcc ggg gtc ggc gag gcg ggc gac gta gtg gag	8496		
Ala Val Val His Ala Ala Gly Val Gly Glu Ala Gly Asp Val Val Glu	2820	2825	2830
atg ggt ttg gcg gat ttt gca gcg gtg ttg tcg gcg aag gtg cgt ggt	8544		
Met Gly Leu Ala Asp Phe Ala Ala Val Leu Ser Ala Lys Val Arg Gly	2835	2840	2845
gcg gcg aat ctg gac gag ttg ctg gcc gac tcg gag ctg gat gcg ttt	8592		
Ala Ala Asn Leu Asp Glu Leu Leu Ala Asp Ser Glu Leu Asp Ala Phe	2850	2855	2860
gtg atg ttc tcc tcg gtg tcg ggg gtg tgg gga gcc ggc gga cag ggt	8640		
Val Met Phe Ser Ser Val Ser Gly Val Trp Gly Ala Gly Gly Gln Gly	2865	2870	2875 2880
gcg tat gcg gct gcg aac gcc tac ttg gat gcg ttg gcc gag cag cgt	8688		
Ala Tyr Ala Ala Ala Asn Ala Tyr Leu Asp Ala Leu Ala Glu Gln Arg	2885	2890	2895
cgg gcg agg gga ttg gtc ggg acc gcg gtt gcg tgg gga ccg tgg gcc	8736		
Arg Ala Arg Gly Leu Val Gly Thr Ala Val Ala Trp Gly Pro Trp Ala	2900	2905	2910
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Gly Asp Gly Met Ala Ala Gly Glu Thr Gly Ala Gln Leu His Arg Met	
2915	2920 2925
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Gly Leu Ala Ser Met Glu Pro Ser Ala Ala Leu Leu Ala Leu Gln Gly	
2930	2935 2940
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Ala Leu Asp Arg Asp Glu Thr Ser Leu Val Val Ala Asp Val Asp Trp	
2945	2950 2955 2960
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Ala Arg Phe Ala Pro Ala Phe Thr Ser Ala Arg Arg Arg Pro Leu Leu	
2965	2970 2975
gac acc atc gac gag gcc cga gcc gca ttg gaa acc acc ggc gaa caa	8976
Asp Thr Ile Asp Glu Ala Arg Ala Ala Leu Glu Thr Thr Gly Glu Gln	
2980	2985 2990
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Ala Gly Thr Gly Lys Pro Val Glu Leu Thr Gln Arg Leu Ala Gly Leu	
2995	3000 3005
tcg cgg aag gaa cgc gac gat gcg gta ttg gat ctg gtg cgg gcg gag	9072
Ser Arg Lys Glu Arg Asp Asp Ala Val Leu Asp Leu Val Arg Ala Glu	
3010	3015 3020
acg gcg gct gtg ctg gga cgc gac gat gcc acg gcc ctg gcg cca tcg	9120
Thr Ala Ala Val Leu Gly Arg Asp Asp Ala Thr Ala Leu Ala Pro Ser	
3025	3030 3035 3040
cgg ccg ttc cag gaa ctc gga ttc gac tcc ttg atg gcg gtg gag ctg	9168
Arg Pro Phe Gln Glu Leu Gly Phe Asp Ser Leu Met Ala Val Glu Leu	
3045	3050 3055
cgc aac cgg ctg aac acc gcc acc ggg atc cag ctg ccc gcc agc acg	9216
Arg Asn Arg Leu Asn Thr Ala Thr Gly Ile Gln Leu Pro Ala Ser Thr	
3060	3065 3070
att ttc gac tac ccc aat gcc gag tcg ctg tcg cgt cac ctc tgc gcc	9264
Ile Phe Asp Tyr Pro Asn Ala Glu Ser Leu Ser Arg His Leu Cys Ala	
3075	3080 3085
gag ctt ttc cca acg gag act acc gtg gac tcg gcc ctt gcc gag ctc	9312
Glu Leu Phe Pro Thr Glu Thr Thr Val Asp Ser Ala Leu Ala Glu Leu	
3090	3095 3100
gat cga atc gag cag cag ctc tcg atg ctc acc ggc gaa gcg cgg gca	9360



Asp Arg Ile Glu Gln Gln Leu Ser Met Leu Thr Gly Glu Ala Arg Ala  
 3105 3110 3115 3120  
 cgg gac cga atc gcg aca cga ctg cga gcc ctc cac gag aag tgg aac 9408  
 Arg Asp Arg Ile Ala Thr Arg Leu Arg Ala Leu His Glu Lys Trp Asn  
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 agc gca gct gaa gta ccg acc gga gcc gat gtc ctg agc acg ctc gat 9456  
 Ser Ala Ala Glu Val Pro Thr Gly Ala Asp Val Leu Ser Thr Leu Asp  
 3140 3145 3150  
 tcg gcg acg cac gac gag ata ttc gag ttc atc gac aac gag ctc gac 9504  
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 ctg tcc tga 9513  
 Leu Ser  
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 <212> PRT  
 <213> Saccharopolyspora spinosa  
 <400> 46  
 Met Ser Asn Glu Glu Lys Leu Arg Glu Tyr Leu Arg Arg Ala Leu Val  
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 Asp Leu His Gln Ala Arg Glu Arg Leu His Glu Ala Glu Ser Gly Glu  
 20 25 30  
 Arg Glu Pro Ile Ala Ile Val Ala Met Gly Cys Arg Tyr Pro Gly Gly  
 35 40 45  
 Val Gln Asp Pro Glu Gly Leu Trp Lys Leu Val Ala Ser Gly Gly Asp  
 50 55 60  
 Ala Ile Gly Glu Phe Pro Ala Asp Arg Gly Trp His Leu Asp Glu Leu  
 65 70 75 80  
 Tyr Asp Pro Asp Pro Asp Gln Pro Gly Thr Cys Tyr Thr Arg His Gly  
 85 90 95  
 Gly Phe Leu His Asp Ala Gly Glu Phe Asp Ala Gly Phe Phe Asp Ile  
 100 105 110  
 Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu

115	120	125
Glu Ile Ser Trp Glu Thr Val Glu Ser Ala Gly Met Asp Pro Arg Ser		
130	135	140
Leu Arg Gly Ser Arg Thr Gly Val Phe Ala Gly Leu Met Tyr Glu Gly		
145	150	155
		160
Tyr Asp Thr Gly Ala His Arg Ala Gly Glu Gly Val Glu Gly Tyr Leu		
165	170	175
Gly Thr Gly Asn Ala Gly Ser Val Ala Ser Gly Arg Val Ala Tyr Ala		
180	185	190
Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser		
195	200	205
Ser Leu Val Ala Leu His Leu Ala Cys Gln Ser Leu Arg Gln Gly Glu		
210	215	220
Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val Met Ser Thr Pro Glu		
225	230	235
		240
Arg Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala Pro Asp Gly Arg		
245	250	255
Cys Lys Ser Phe Ala Ala Ala Ala Asp Gly Thr Gly Trp Gly Glu Gly		
260	265	270
Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly		
275	280	285
His Arg Val Leu Ala Val Val Arg Gly Ser Ala Val Asn Gln Asp Gly		
290	295	300
Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Leu Ala Gln Glu Arg Val		
305	310	315
		320
Ile Gln Gln Val Leu Thr Ser Ala Gly Leu Ser Ala Ser Asp Val Asp		
325	330	335
Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly Asp Pro Ile Glu		
340	345	350
Ala Gln Ala Leu Ile Ala Ala Tyr Gly Gln Asp Arg Asp Arg Asp Arg		
355	360	365
Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly His Thr Gln Ala		

370

375

380

Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met Ala Met Arg His  
 385 390 395 400

Gly Glu Leu Pro Arg Thr Leu His Val Asp Glu Pro Asn Ser His Val  
 405 410 415

Asp Trp Ser Ala Gly Ala Val Arg Leu Leu Thr Glu Asn Ile Arg Trp  
 420 425 430

Pro Gly Thr Gly Thr Arg Arg Ala Gly Val Ser Ser Phe Gly Val Ser  
 435 440 445

Gly Thr Asn Ala His Val Ile Leu Glu His Asp Pro Leu Ala Val Thr  
 450 455 460

Glu Asn Glu Glu Ala Ala Gln Ser Pro Ala Pro Gly Ile Val Pro Trp  
 465 470 475 480

Ala Leu Ser Gly Arg Ser Ser Thr Ala Leu Arg Ala Gln Ala Glu Arg  
 485 490 495

Leu Arg Glu Leu Cys Glu Gln Thr Asp Pro Asp Pro Val Asp Val Gly  
 500 505 510

Phe Ser Leu Ala Ala Thr Arg Thr Ala Trp Glu His Arg Ala Val Val  
 515 520 525

Leu Gly Arg Asp Ser Ala Thr Leu Arg Ser Gly Leu Gly Val Val Ala  
 530 535 540

Ser Gly Glu Pro Ala Val Asp Val Val Glu Gly Ser Val Leu Asp Gly  
 545 550 555 560

Glu Val Val Phe Val Phe Pro Gly Gln Gly Trp Gln Trp Ala Gly Met  
 565 570 575

Ala Val Asp Leu Leu Asp Ala Ser Pro Thr Phe Ala Arg His Met Asp  
 580 585 590

Glu Cys Ala Thr Ala Leu Arg Arg Tyr Val Asp Trp Ser Leu Val Asp  
 595 600 605

Val Leu Arg Gly Ala Glu Asn Ser Pro Pro Leu Asp Arg Val Asp Val  
 610 615 620

Leu Gln Pro Ala Ser Phe Ala Val Met Val Ser Leu Ala Glu Val Trp

625	630	635	640
Arg Ser Tyr Gly Val Arg Pro Ala Ala Val Val Gly His Ser Gln Gly	645	650	655
Glu Ile Ala Ala Ala Cys Ala Ala Gly Val Leu Pro Leu Glu Asp Ala	660	665	670
Ala Arg Leu Val Ala Leu Arg Ser Arg Ala Leu Lys Gly Leu Ser Gly	675	680	685
Arg Gly Gly Met Ala Ser Leu Ala Cys Pro Ala Asp Glu Val Ala Ala	690	695	700
Leu Phe Ala Gly Ser Gly Gly Arg Leu Glu Val Ala Ala Ile Asn Gly	705	710	715
Pro Arg Ser Val Val Val Ser Gly Asp Leu Glu Ala Val Asp Glu Leu	725	730	735
Leu Ala Glu Cys Ala Glu Lys Asp Met Arg Ala Arg Arg Ile Pro Val	740	745	750
Asp Tyr Ala Ser His Ser Ala His Val Glu Val Val Arg Ser Pro Val	755	760	765
Leu Ala Ala Ala Ala Gly Val Arg His Arg Asp Gly Gln Val Pro Trp	770	775	780
Trp Ser Thr Val Ile Gly Asp Trp Val Asp Pro Ala Arg Leu Asp Gly	785	790	795
Glu Tyr Trp Tyr Arg Asn Leu Arg Gln Pro Val Arg Phe Glu His Ala	805	810	815
Val Gln Gly Leu Val Glu Arg Gly Phe Gly Leu Phe Ile Glu Met Ser	820	825	830
Ala His Pro Val Leu Thr Thr Ala Val Glu Glu Thr Gly Ala Glu Ser	835	840	845
Glu Thr Ala Val Ala Ala Val Gly Thr Leu Arg Arg Asp Ser Gly Gly	850	855	860
Leu Arg Arg Leu Leu His Ser Leu Ala Glu Ala Tyr Val Arg Gly Ala	865	870	875
Thr Val Asp Trp Ala Val Ala Phe Gly Gly Ala Gly Arg Arg Leu Asp			880

885	890	895
Leu Pro Thr Tyr Pro Phe Gln Arg	Gln Arg Tyr Trp Leu Asp Lys Gly	
900	905	910
Ala Ala Ser Asp Glu Ala Arg Ala Val Ser Asp Pro Ala Ala Gly Trp		
915	920	925
Phe Trp Gln Ala Val Ala Arg Gln Asp Leu Lys Ser Val Ser Asp Ala		
930	935	940
Leu Asp Leu Asp Ala Asp Ala Pro Leu Ser Ala Thr Leu Pro Ala Leu		
945	950	955 960
Ser Val Trp His Arg Gln Glu Arg Glu Arg Val Leu Ala Asp Gly Trp		
965	970	975
Arg Tyr Arg Val Asp Trp Val Arg Val Ala Pro Gln Pro Val Arg Arg		
980	985	990
Thr Arg Glu Thr Trp Leu Leu Val Val Pro Pro Gly Gly Ile Glu Glu		
995	1000	1005
Ala Leu Val Glu Arg Leu Thr Asp Ala Leu Asn Thr Arg Gly Ile Ser		
1010	1015	1020
Thr Leu Arg Leu Asp Val Pro Pro Ala Ala Thr Ser Gly Glu Leu Ala		
1025	1030	1035 1040
Thr Glu Leu Arg Ala Ala Ala Asp Gly Asp Pro Val Lys Ala Ile Leu		
1045	1050	1055
Ser Leu Thr Ala Leu Asp Glu Arg Pro His Pro Glu Cys Lys Asp Val		
1060	1065	1070
Pro Ser Gly Ile Ala Leu Leu Leu Asn Leu Val Lys Ala Leu Gly Glu		
1075	1080	1085
Ala Asp Leu Arg Ile Pro Leu Trp Thr Ile Thr Arg Gly Ala Val Lys		
1090	1095	1100
Ala Gly Pro Ala Asp Arg Leu Leu Arg Pro Met Gln Ala Gln Ala Trp		
1105	1110	1115 1120
Gly Leu Gly Arg Val Ala Ala Leu Glu His Pro Glu Arg Trp Gly Gly		
1125	1130	1135
Leu Ile Asp Leu Pro Asp Ser Leu Asp Gly Asp Val Leu Thr Arg Leu		

1140	1145	1150
Gly Glu Ala Leu Thr Asn Gly Leu Ala Glu Asp Gln Leu Ala Ile Arg		
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Gln Ser Gly Val Leu Ala Arg Arg Leu Val Pro Ala Pro Ala Asn Gln		
1170	1175	1180
Pro Ala Gly Arg Lys Trp Arg Pro Arg Gly Ser Ala Leu Ile Thr Gly		
1185	1190	1195 1200
Gly Leu Gly Ala Val Gly Ala Gln Val Ala Arg Trp Leu Ala Glu Ile		
1205	1210	1215
Gly Ala Glu Arg Ile Val Leu Thr Ser Arg Arg Gly Asn Gln Ala Ala		
1220	1225	1230
Gly Ala Ala Glu Leu Glu Ala Glu Leu Arg Ala Leu Gly Ala Gln Val		
1235	1240	1245
Ser Ile Val Ala Cys Asp Val Thr Asp Arg Ala Glu Met Ser Ala Leu		
1250	1255	1260
Leu Ala Glu Phe Asp Val Thr Ala Val Phe His Ala Ala Gly Val Gly		
1265	1270	1275 1280
Arg Leu Leu Pro Leu Ala Glu Thr Asp Gln Asn Gly Leu Ala Glu Ile		
1285	1290	1295
Cys Ala Ala Lys Val Arg Gly Ala Gln Val Leu Asp Glu Leu Cys Asp		
1300	1305	1310
Ser Thr Asp Leu Asp Ala Phe Val Leu Phe Ser Ser Gly Ala Gly Val		
1315	1320	1325
Trp Gly Gly Gly Gly Gln Gly Ala Tyr Gly Ala Ala Asn Ala Phe Leu		
1330	1335	1340
Asp Thr Leu Ala Glu Gln Arg Arg Ala Arg Gly Leu Pro Ala Thr Ser		
1345	1350	1355 1360
Ile Ser Trp Gly Ser Trp Ala Gly Gly Gly Met Ala Asp Gly Ala Ala		
1365	1370	1375
Gly Glu His Leu Arg Arg Arg Gly Ile Arg Pro Met Pro Ala Ala Ser		
1380	1385	1390
Ala Ile Leu Ala Leu Gln Glu Val Leu Asp Gln Asp Glu Thr Cys Val		

1395	1400	1405
Ser Ile Ala Asp Val Asp Trp Asp Arg Phe Val Pro Thr Phe Ala Ala		
1410	1415	1420
Thr Arg Ala Thr Arg Leu Phe Asp Glu Val Pro Ala Ala Arg Lys Ala		
425	1430	1435 1440
Met Pro Ala Asn Gly Pro Ala Glu Pro Gly Gly Ser Pro Phe Ala Arg		
1445	1450	1455
Asn Leu Ala Glu Leu Pro Glu Ala Gln Arg Arg His Glu Leu Val Asp		
1460	1465	1470
Leu Val Cys Ala Gln Val Ala Thr Val Leu Gly His Gly Ser Arg Glu		
1475	1480	1485
Glu Val Gln Pro Glu Arg Ala Phe Arg Ala Leu Gly Phe Asp Ser Leu		
1490	1495	1500
Met Ala Val Asp Leu Arg Asn Arg Leu Thr Thr Ala Thr Gly Leu Arg		
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Leu Pro Thr Thr Thr Val Phe Asp Tyr Pro Asn Pro Ala Ala Leu Ala		
1525	1530	1535
Ala His Leu Leu Glu Glu Leu Val Gly Asp Val Ala Ser Ala Ala Val		
1540	1545	1550
Thr Ala Ala Ser Ala Pro Ala Ser Asp Glu Pro Ile Ala Ile Val Ala		
1555	1560	1565
Met Ser Cys Arg Phe Pro Gly Gly Ala His Ser Pro Glu Asp Leu Trp		
1570	1575	1580
Arg Leu Val Ala Ala Gly Thr Glu Val Ile Gly Glu Phe Pro Ser Asp		
585	1590	1595 1600
Arg Gly Trp Asp Ala Glu Gly Leu Tyr Asp Pro Asp Ala Ser Arg Pro		
1605	1610	1615
Gly Thr Thr Tyr Ala Arg Met Ala Gly Phe Leu Tyr Asp Ala Gly Glu		
1620	1625	1630
Phe Asp Ala Asp Leu Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met		
1635	1640	1645
Asp Pro Gln Gln Arg Leu Val Leu Glu Ile Ala Trp Glu Ala Leu Glu		

1650	1655	1660
Arg Ala Gly Ile Asp Pro Leu Ser Leu Lys Gly Ser Gly Val Gly Thr 665	1670	1675 1680
Tyr Ile Gly Ala Gly Ser Arg Gly Tyr Ala Thr Asp Val Arg Gln Phe 1685	1690	1695
Pro Glu Glu Ala Glu Gly Tyr Leu Leu Thr Gly Thr Ser Ala Ser Val 1700	1705	1710
Leu Ser Gly Arg Val Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val 1715	1720	1725
Thr Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala 1730	1735	1740
Cys Gln Ser Leu Arg Ser Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly 745	1750	1755 1760
Val Thr Val Met Ser Thr Pro Glu Met Phe Val Glu Phe Ser Arg Gln 1765	1770	1775
Arg Gly Leu Ala Pro Asp Gly Arg Cys Lys Ser Phe Ala Glu Ser Ala 1780	1785	1790
Asp Gly Thr Gly Trp Gly Glu Gly Ala Gly Leu Leu Leu Leu Glu Arg 1795	1800	1805
Leu Ser Asp Ala His Arg Asn Gly His Arg Val Leu Ala Val Val Arg 1810	1815	1820
Gly Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Ala Ala Pro 825	1830	1835 1840
Asn Gly Pro Ser Gln Gln Arg Val Ile Asn Gln Ala Leu Ala Asn Ala 1845	1850	1855
Ala Leu Ser Ala Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly 1860	1865	1870
Thr Arg Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr 1875	1880	1885
Gly Gln Ala Arg Glu Arg Asp Arg Pro Leu Trp Leu Gly Ser Val Lys 1890	1895	1900
Ser Asn Ile Gly His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile		



905	1910	1915	1920
Lys Met Val Met Ala Met Arg His Gly Gln Leu Pro Ala Ser Leu His			
1925	1930	1935	
Ala Asp Glu Pro Thr Ser Glu Val Asp Trp Ser Ser Gly Ala Val Arg			
1940	1945	1950	
Leu Leu Ala Glu Gln Val Pro Trp Pro Glu Ser Asp Arg Val Arg Arg			
1955	1960	1965	
Val Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile			
1970	1975	1980	
Leu Glu Gln Ala Thr Asn Ala Pro Asp Ser Thr Ala Glu Thr Asp Lys			
985	1990	1995	2000
Thr Glu Ser Gly Ser Thr Val Asp Ile Pro Val Val Pro Trp Leu Val			
2005	2010	2015	
Ser Gly Lys Thr Thr Asp Ser Leu Arg Gly Gln Ala Glu Arg Val Leu			
2020	2025	2030	
Ser Gln Val Glu Ser Arg Pro Glu Gln Arg Ser Leu Asp Val Ala Tyr			
2035	2040	2045	
Ser Leu Ala Ser Gly Arg Ala Ala Leu Asp Glu Arg Ala Val Val Leu			
2050	2055	2060	
Gly Ala Asp Arg Gly Glu Leu Val Ala Gly Leu Ala Ala Leu Ala Ala			
065	2070	2075	2080
Gly Gln Glu Ala Ser Gly Val Ile Ser Gly Thr Arg Ala Ser Ala Arg			
2085	2090	2095	
Phe Gly Phe Val Phe Ser Gly Gln Gly Gly Gln Trp Leu Gly Met Gly			
2100	2105	2110	
Arg Ala Leu Tyr Ser Lys Phe Pro Val Phe Ala Ala Ala Phe Asp Glu			
2115	2120	2125	
Ala Cys Ala Glu Leu Glu Ala His Leu Gly Glu Asp Arg Arg Val Arg			
2130	2135	2140	
Asp Val Val Phe Gly Ser Asp Ala Gln Leu Leu Asp Gln Thr Leu Trp			
145	2150	2155	2160
Ala Gln Ser Gly Leu Phe Ala Leu Gln Ala Gly Leu Leu Gly Leu Leu			

2165	2170	2175
Gly Ser Trp Gly Val Arg Pro Asp Val Val Met Gly His Ser Val Gly		
2180	2185	2190
Glu Leu Ala Ala Ala Phe Ala Ala Gly Val Leu Ser Leu Arg Asp Ala		
2195	2200	2205
Ala Arg Leu Val Ala Ala Arg Ala Arg Leu Met Gln Ala Leu Pro Ser		
2210	2215	2220
Asp Gly Ala Met Leu Ala Val Ala Ala Gly Glu Asp Leu Val Arg Pro		
2225	2230	2235
		2240
Leu Leu Ala Gly Arg Glu Glu Ser Val Ser Val Ala Ala Leu Asn Ala		
2245	2250	2255
Pro Gly Ser Val Val Leu Ser Gly Asp Arg Glu Val Leu Ala Ser Ile		
2260	2265	2270
Val Gly Arg Leu Thr Glu Leu Arg Val Arg Thr Arg Arg Leu Arg Val		
2275	2280	2285
Ser His Ala Phe His Ser His Arg Met Asp Pro Met Leu Gly Glu Phe		
2290	2295	2300
Ala Gln Ile Ala Glu Ser Ala Glu Phe Gly Lys Pro Thr Thr Pro Leu		
305	2310	2315
		2320
Val Ser Thr Leu Thr Gly Glu Leu Asp Arg Ala Ala Glu Met Ser Thr		
2325	2330	2335
Pro Gly Tyr Trp Val Arg Gln Ala Arg Glu Pro Val Arg Phe Ala Asp		
2340	2345	2350
Gly Val Gln Ala Leu Ala Ala Gln Gly Ile Gly Thr Val Val Glu Leu		
2355	2360	2365
Gly Pro Asp Gly Thr Leu Ala Ala Leu Val Arg Glu Cys Ala Thr Glu		
2370	2375	2380
Ser Asp Arg Val Gly Arg Ile Ser Ser Ile Pro Leu Met Arg Arg Glu		
385	2390	2395
		2400
Arg Asp Glu Thr Arg Ser Val Met Thr Ala Leu Ala His Leu His Thr		
2405	2410	2415
Arg Gly Gly Glu Val Asp Trp Gln Ala Phe Phe Ala Gly Thr Gly Ala		

2420	2425	2430
Arg Gln Leu Glu Leu Pro Thr Tyr Ala Phe Gln Arg Gln His Tyr Trp		
2435	2440	2445
Ile Glu Ser Ser Ala Arg Pro Ala Arg Asp Arg Ala Asp Ile Gly Glu		
2450	2455	2460
Val Ala Glu Gln Phe Trp Thr Ala Val Asp Gln Gly Asp Leu Ala Thr		
465	2470	2475 2480
Leu Val Ala Ala Leu Asp Leu Gly Ala Asp Asp Asp Thr Cys Ala Ser		
2485	2490	2495
Leu Ser Asp Val Leu Pro Ala Leu Ser Ser Trp Arg Ser Gly Leu Arg		
2500	2505	2510
Asn Arg Ser Leu Val Asp Ser Cys Arg Tyr Arg Ile Ser Trp His Ser		
2515	2520	2525
Ser Arg Glu Val Pro Ala Pro Lys Ile Ser Gly Thr Trp Leu Leu Val		
2530	2535	2540
Val Pro Gly Ala Ala Asp Asp Gly Leu Val Thr Ala Leu Thr Ser Ser		
545	2550	2555 2560
Leu Val Gly Gly Gly Ala Glu Val Val Arg Ile Gly Leu Ser Glu Glu		
2565	2570	2575
Asp Pro His Arg Glu Asp Val Ala Gln Arg Leu Ala Asn Ala Leu Thr		
2580	2585	2590
Asp Ala Gly Gln Leu Gly Gly Val Leu Ser Leu Leu Gly Leu Asp Glu		
2595	2600	2605
Ser Pro Ala Pro Gly Phe Ser Cys Leu Pro Thr Gly Phe Ala Leu Thr		
2610	2615	2620
Val Gln Leu Leu Arg Ala Leu Arg Lys Ala Asp Val Glu Ala Pro Phe		
625	2630	2635 2640
Trp Ala Val Thr Arg Gly Gly Val Ala Leu Glu Asp Val Arg Val Ser		
2645	2650	2655
Pro Glu Gln Ala Leu Val Trp Gly Leu Leu Arg Val Ala Gly Leu Glu		
2660	2665	2670
His Pro Glu Phe Trp Gly Gly Leu Ile Asp Leu Pro Ser Asp Trp Asp		

2675	2680	2685
Asp Arg Leu Gly Ala Arg Leu Ala Gly Val Leu Ala Asp Gly Gly Glu		
2690	2695	2700
Asp Gln Val Ala Ile Arg Arg Gly Gly Val Phe Val Arg Arg Leu Glu		
705	2710	2715 2720
Arg Ala Gly Ala Ser Gly Ala Gly Ser Val Trp Arg Pro Arg Gly Thr		
2725	2730	2735
Val Leu Val Thr Gly Gly Thr Gly Gly Leu Gly Ala His Val Ala Arg		
2740	2745	2750
Trp Leu Ala Gly Ala Gly Ala Glu His Val Val Leu Thr Ser Arg Arg		
2755	2760	2765
Gly Ala Asp Ala Pro Gly Ala Gly Glu Leu Arg Ala Glu Leu Glu Ala		
2770	2775	2780
Leu Gly Ala Arg Val Ser Ile Val Pro Cys Asp Val Ala Asp Arg Asp		
785	2790	2795 2800
Ala Val Ala Gly Val Leu Ala Gly Ile Gly Gly Glu Cys Pro Leu Thr		
2805	2810	2815
Ala Val Val His Ala Ala Gly Val Gly Glu Ala Gly Asp Val Val Glu		
2820	2825	2830
Met Gly Leu Ala Asp Phe Ala Ala Val Leu Ser Ala Lys Val Arg Gly		
2835	2840	2845
Ala Ala Asn Leu Asp Glu Leu Leu Ala Asp Ser Glu Leu Asp Ala Phe		
2850	2855	2860
Val Met Phe Ser Ser Val Ser Gly Val Trp Gly Ala Gly Gly Gln Gly		
865	2870	2875 2880
Ala Tyr Ala Ala Ala Asn Ala Tyr Leu Asp Ala Leu Ala Glu Gln Arg		
2885	2890	2895
Arg Ala Arg Gly Leu Val Gly Thr Ala Val Ala Trp Gly Pro Trp Ala		
2900	2905	2910
Gly Asp Gly Met Ala Ala Gly Glu Thr Gly Ala Gln Leu His Arg Met		
2915	2920	2925
Gly Leu Ala Ser Met Glu Pro Ser Ala Ala Leu Leu Ala Leu Gln Gly		

2930	2935	2940	
Ala Leu Asp Arg Asp Glu Thr Ser Leu Val Val Ala Asp Val Asp Trp			
945	2950	2955	2960
Ala Arg Phe Ala Pro Ala Phe Thr Ser Ala Arg Arg Arg Pro Leu Leu			
2965	2970	2975	
Asp Thr Ile Asp Glu Ala Arg Ala Ala Leu Glu Thr Thr Gly Glu Gln			
2980	2985	2990	
Ala Gly Thr Gly Lys Pro Val Glu Leu Thr Gln Arg Leu Ala Gly Leu			
2995	3000	3005	
Ser Arg Lys Glu Arg Asp Asp Ala Val Leu Asp Leu Val Arg Ala Glu			
3010	3015	3020	
Thr Ala Ala Val Leu Gly Arg Asp Asp Ala Thr Ala Leu Ala Pro Ser			
025	3030	3035	3040
Arg Pro Phe Gln Glu Leu Gly Phe Asp Ser Leu Met Ala Val Glu Leu			
3045	3050	3055	
Arg Asn Arg Leu Asn Thr Ala Thr Gly Ile Gln Leu Pro Ala Ser Thr			
3060	3065	3070	
Ile Phe Asp Tyr Pro Asn Ala Glu Ser Leu Ser Arg His Leu Cys Ala			
3075	3080	3085	
Glu Leu Phe Pro Thr Glu Thr Thr Val Asp Ser Ala Leu Ala Glu Leu			
3090	3095	3100	
Asp Arg Ile Glu Gln Gln Leu Ser Met Leu Thr Gly Glu Ala Arg Ala			
105	3110	3115	3120
Arg Asp Arg Ile Ala Thr Arg Leu Arg Ala Leu His Glu Lys Trp Asn			
3125	3130	3135	
Ser Ala Ala Glu Val Pro Thr Gly Ala Asp Val Leu Ser Thr Leu Asp			
3140	3145	3150	
Ser Ala Thr His Asp Glu Ile Phe Glu Phe Ile Asp Asn Glu Leu Asp			
3155	3160	3165	
Leu Ser			
3170			

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&lt;210&gt; 47

&lt;211&gt; 14775

&lt;212&gt; DNA

&lt;213&gt; Saccharopolyspora spinosa

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(14772)

&lt;223&gt; ORF21; Polyketidsynthase

&lt;400&gt; 47

atg gcc aat gaa gaa aag ctc ttc ggc tat ctg aag aag gta act gcg 48  
 Met Ala Asn Glu Glu Lys Leu Phe Gly Tyr Leu Lys Lys Val Thr Ala  
 1 5 10 15

gac ctg cat cag acc cgg cag cgc ctg ctc gcg gcc gag agc cgg agt 96  
 Asp Leu His Gln Thr Arg Gln Arg Leu Leu Ala Ala Glu Ser Arg Ser  
 20 25 30

cag gag ccg atc gcg atc gtc tgc gcg agc tgc cga ctg ccc ggc ggc 144  
 Gln Glu Pro Ile Ala Ile Val Ser Ala Ser Cys Arg Leu Pro Gly Gly  
 35 40 45

gtc gac tct ccc gaa gcg ctc tgg caa ctc gtg cgc act ggc acc gac 192  
 Val Asp Ser Pro Glu Ala Leu Trp Gln Leu Val Arg Thr Gly Thr Asp  
 50 55 60

gcc atc tgc gag ttc ccc gcc gac cgg ggc tgg gat ctc ggc cgg ttg 240  
 Ala Ile Ser Glu Phe Pro Ala Asp Arg Gly Trp Asp Leu Gly Arg Leu  
 65 70 75 80

tac gat ccc gac ccg aac cac cag gga acg tgc tac acg cgg gcc ggc 288  
 Tyr Asp Pro Asp Pro Asn His Gln Gly Thr Ser Tyr Thr Arg Ala Gly  
 85 90 95

ggt ttc ctc gca gga gcg ggc gat ttc gac ccc gcc atg ttc ggg att 336  
 Gly Phe Leu Ala Gly Ala Gly Asp Phe Asp Pro Ala Met Phe Gly Ile  
 100 105 110

tcg ccg cgt gag gcg ttg gcg atg gac ccg cag caa cgg ttg ttg ctg 384  
 Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu  
 115 120 125

gag ctg tcc tgg gag gcc ctc gaa cgg gcg ggc ata gac ccg aca tcc 432  
 Glu Leu Ser Trp Glu Ala Leu Glu Arg Ala Gly Ile Asp Pro Thr Ser  
 130 135 140

ctg cgc ggc agc aag acc ggt gtc ttc ggt ggt gtc acg ccc cag gag	480
Leu Arg Gly Ser Lys Thr Gly Val Phe Gly Gly Val Thr Pro Gln Glu	
145                      150                      155                      160	
tac ggg ccg tcc ttg cag gag atg agc cga aac gct ggg ggt ttt gga	528
Tyr Gly Pro Ser Leu Gln Glu Met Ser Arg Asn Ala Gly Gly Phe Gly	
165                      170                      175	
ctc acc ggg cgg atg gtg agt gtg gcg tcg ggt cgg gtt gcg tat tcg	576
Leu Thr Gly Arg Met Val Ser Val Ala Ser Gly Arg Val Ala Tyr Ser	
180                      185                      190	
ttt ggt ttt gag ggt cct gcg gtg acg gtg gat acg gcg tgt tcg tcg	624
Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser	
195                      200                      205	
tcg ttg gtg gcc ctg cat ttg gcg tgt cag tcg ttg cgt tcc ggc gaa	672
Ser Leu Val Ala Leu His Leu Ala Cys Gln Ser Leu Arg Ser Gly Glu	
210                      215                      220	
tgc gat ctc gcg ctg gcc ggc ggt gtg acg gtg atg gcg aca ccg gcg	720
Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val Met Ala Thr Pro Ala	
225                      230                      235                      240	
acg ttc gtg gag ttc tcc cgt cag cgt ggt ttg gct ccg gac ggg cgg	768
Thr Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala Pro Asp Gly Arg	
245                      250                      255	
tgc aag tcg ttc gcg gct gcc gcg gat ggc acc ggg tgg ggt gag ggt	816
Cys Lys Ser Phe Ala Ala Ala Ala Asp Gly Thr Gly Trp Gly Glu Gly	
260                      265                      270	
gcc ggt ctg gtg ttg ctg gag cgg ttg tcg gat gcg cgg cgg aat ggg	864
Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly	
275                      280                      285	
cac gag gtt ctg gcg gtg gtg cgg ggt agc gcg gtg aac cag gac ggc	912
His Glu Val Leu Ala Val Val Arg Gly Ser Ala Val Asn Gln Asp Gly	
290                      295                      300	
gcg tcg aat ggt ttg act gcg ccg aat ggt ccg tcg cag cag cgg gtg	960
Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser Gln Gln Arg Val	
305                      310                      315                      320	
atc acc cag gcg ttg gcg agt gcg ggg ctg tcg gtt tcc gat gtg gat	1008
Ile Thr Gln Ala Leu Ala Ser Ala Gly Leu Ser Val Ser Asp Val Asp	
325                      330                      335	

gcg gtc gag gca cat ggg acc ggg acc acg ttg ggt gat ccg atc gag	1056
Ala Val Glu Ala His Gly Thr Gly Thr Leu Gly Asp Pro Ile Glu	
340 345 350	
gca cag gcc ctg atc gcc acg tac ggg cag ggc cgg gag aag gat cgg	1104
Ala Gln Ala Leu Ile Ala Thr Tyr Gly Gln Gly Arg Glu Lys Asp Arg	
355 360 365	
ccg ttg tgg ttg ggg tcg gtc aag tcc aac atc ggt cac acg cag gcg	1152
Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly His Thr Gln Ala	
370 375 380	
gcc gct ggc gtt gcc ggc gtc atc aag atg gtc ttg gcg atg cgg cac	1200
Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Leu Ala Met Arg His	
385 390 395 400	
ggg cag ctg ccc gcc acg ttg cat gtg gat gag ccc acg tcg gcg gtg	1248
Gly Gln Leu Pro Ala Thr Leu His Val Asp Glu Pro Thr Ser Ala Val	
405 410 415	
gac tgg tcg gcg ggt tcg gtc cgg ctt ctc acg gag aac acg ccc tgg	1296
Asp Trp Ser Ala Gly Ser Val Arg Leu Leu Thr Glu Asn Thr Pro Trp	
420 425 430	
ccg gac agt ggt cgt cct tgc cgg gtg ggg gtg tcg tcg ttc ggg atc	1344
Pro Asp Ser Gly Arg Pro Cys Arg Val Gly Val Ser Ser Phe Gly Ile	
435 440 445	
agc ggc acc aac gca cat gtg att ctc gaa cag tct cca gtc gag cag	1392
Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Ser Pro Val Glu Gln	
450 455 460	
ggc gaa ccg gcc ggg ccg gtc gaa ggc gag cgg gaa ccg gat gta gcc	1440
Gly Glu Pro Ala Gly Pro Val Glu Gly Glu Arg Glu Pro Asp Val Ala	
465 470 475 480	
gtc ccc gtg gtg cct tgg gtg ctg tcg ggt aag aca ccg gag gct gcg	1488
Val Pro Val Val Pro Trp Val Leu Ser Gly Lys Thr Pro Glu Ala Ala	
485 490 495	
cgg gcg cag gcc gaa ccg gtg cat tcg cat atc gag gac cgg ccg ggg	1536
Arg Ala Gln Ala Glu Arg Val His Ser His Ile Glu Asp Arg Pro Gly	
500 505 510	
ctg tcg ccg gtg gat gtg gcg tat tcg cta gga atg aca cgc gcg gcg	1584
Leu Ser Pro Val Asp Val Ala Tyr Ser Leu Gly Met Thr Arg Ala Ala	
515 520 525	



ctg gat gaa cgc gca gtg gtg ttg ggc tcg gac cgt gcc gcg ctc ctg	1632
Leu Asp Glu Arg Ala Val Val Leu Gly Ser Asp Arg Ala Ala Leu Leu	
530 535 540	
acc ggg ttg agg gca ttc gcc gac ggc tgc gat gcg ccc gaa gtg gtt	1680
Thr Gly Leu Arg Ala Phe Ala Asp Gly Cys Asp Ala Pro Glu Val Val	
545 550 555 560	
tcg ggg tct gtg ggg ctt ggt ggc cgc gtc ggg ttc gtg ttc tcg ggt	1728
Ser Gly Ser Val Gly Leu Gly Gly Arg Val Gly Phe Val Phe Ser Gly	
565 570 575	
cag ggt ggt cag tgg ccg ggg atg ggc cgg ggg ctc tac tcg gtg ttt	1776
Gln Gly Gly Gln Trp Pro Gly Met Gly Arg Gly Leu Tyr Ser Val Phe	
580 585 590	
ccg gtg ttc gcc gac gcg ttc gac gag gct tgc gcg gag ttg gat gca	1824
Pro Val Phe Ala Asp Ala Phe Asp Glu Ala Cys Ala Glu Leu Asp Ala	
595 600 605	
cac ctg ggc cag gaa ctg cgg gtt cgg gat gtg gtg ttc ggt tcg caa	1872
His Leu Gly Gln Glu Leu Arg Val Arg Asp Val Val Phe Gly Ser Gln	
610 615 620	
gcg tgg ttg ctg gat cgg acg gtg tgg gcg cag tcg ggt ttg ttc gcg	1920
Ala Trp Leu Leu Asp Arg Thr Val Trp Ala Gln Ser Gly Leu Phe Ala	
625 630 635 640	
ttg cag att ggc ttg ctg cgg ctg ctg ggt tcg tgg ggt gtt cgg ccg	1968
Leu Gln Ile Gly Leu Leu Arg Leu Leu Gly Ser Trp Gly Val Arg Pro	
645 650 655	
gat gtg gtg ttg ggg cac tcg gtg ggt gag ctg gct gcg gtg cat gcg	2016
Asp Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Val His Ala	
660 665 670	
gct ggt gtg ttg tcg ttg tcg gag gcc gcg cgg ttg gtg gcg ggt cgc	2064
Ala Gly Val Leu Ser Leu Ser Glu Ala Ala Arg Leu Val Ala Gly Arg	
675 680 685	
gcc cgg ttg atg cag gcg ttg cct tct ggt ggt gcc atg ctc gcg gtc	2112
Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Ala Met Leu Ala Val	
690 695 700	
gct acg ggt gag ttt cag gtc gat cct ctg ctg gat ggg gtg cgg gac	2160
Ala Thr Gly Glu Phe Gln Val Asp Pro Leu Leu Asp Gly Val Arg Asp	
705 710 715 720	

cgg atc ggt atc gcg gcg gtg aat ggc ccg gaa tcg gtt gtg ctc tct	2208
Arg Ile Gly Ile Ala Ala Val Asn Gly Pro Glu Ser Val Val Leu Ser	
725 730 735	
ggt gac cgc gag ctg ctc acc gag atc gct gat cgg ttg cac gat cag	2256
Gly Asp Arg Glu Leu Leu Thr Glu Ile Ala Asp Arg Leu His Asp Gln	
740 745 750	
ggg tgc cgg acc cgg tgg ttg cgg gtg tcg cat gct ttc cat tcg ccc	2304
Gly Cys Arg Thr Arg Trp Leu Arg Val Ser His Ala Phe His Ser Pro	
755 760 765	
cat atg gag ccg atg ctg gag gag ttc gcc cag atc tcc cga ggc cgc	2352
His Met Glu Pro Met Leu Glu Glu Phe Ala Gln Ile Ser Arg Gly Arg	
770 775 780	
gaa tat cac gca ccg gaa ctg ccg atc atc tcg acc ctg atc ggt gag	2400
Glu Tyr His Ala Pro Glu Leu Pro Ile Ile Ser Thr Leu Ile Gly Glu	
785 790 795 800	
ctg gac ggt ggt cga gtg atg ggc act ccc gag tac tgg gtg cgt cag	2448
Leu Asp Gly Gly Arg Val Met Gly Thr Pro Glu Tyr Trp Val Arg Gln	
805 810 815	
gtg cgt gag ccc gtc cgt ttc gcc gag ggt gtc cag gcg ctt gtc ggt	2496
Val Arg Glu Pro Val Arg Phe Ala Glu Gly Val Gln Ala Leu Val Gly	
820 825 830	
cag ggt gtc ggc acg att gtc gaa ttg ggt ccg gac ggg gcg ttg tcg	2544
Gln Gly Val Gly Thr Ile Val Glu Leu Gly Pro Asp Gly Ala Leu Ser	
835 840 845	
acg ttg gtc gag gag tgt gtg gcg gaa tcc ggg cgg gtg gcc ggg atc	2592
Thr Leu Val Glu Glu Cys Val Ala Glu Ser Gly Arg Val Ala Gly Ile	
850 855 860	
ccg ctg atg cgc aag gac cgc gac gag gcg cga acc gtg ctg gca gct	2640
Pro Leu Met Arg Lys Asp Arg Asp Glu Ala Arg Thr Val Leu Ala Ala	
865 870 875 880	
ttg gcg cag atc cac acc cgt ggt ggt gag gtg gac tgg cgg tcg ttt	2688
Leu Ala Gln Ile His Thr Arg Gly Gly Glu Val Asp Trp Arg Ser Phe	
885 890 895	
ttc gcc ggt acc ggg gcg aag caa gtc gac ctg ccc acc tac gcc ttc	2736
Phe Ala Gly Thr Gly Ala Lys Gln Val Asp Leu Pro Thr Tyr Ala Phe	
900 905 910	

cag cgg cag cgg tac tgg ctg gca tcc acc ggg cgt gcg ggt gac gtg	2784
Gln Arg Gln Arg Tyr Trp Leu Ala Ser Thr Gly Arg Ala Gly Asp Val	
915 920 925	
acc gcc gcc gga ttg gcc gag gcg gac cat ccg ctg ctc ggt gcg gtg	2832
Thr Ala Ala Gly Leu Ala Glu Ala Asp His Pro Leu Leu Gly Ala Val	
930 935 940	
gtt gcg ttg gca gac ggc gaa ggt gtg gtg ctg acc ggt cgg ttg aca	2880
Val Ala Leu Ala Asp Gly Glu Gly Val Val Leu Thr Gly Arg Leu Thr	
945 950 955 960	
gcg ggt tcg cat ccg tgg ttg tcc gat cac cgg gtg ctg ggc gaa atc	2928
Ala Gly Ser His Pro Trp Leu Ser Asp His Arg Val Leu Gly Glu Ile	
965 970 975	
gtc gtc ccc ggc acc gcg atc gtc gag ctg gtg tgg cac gtc ggc gag	2976
Val Val Pro Gly Thr Ala Ile Val Glu Leu Val Trp His Val Gly Glu	
980 985 990	
cgc ctc ggt tgt ggc cgg gtg gaa gaa ctg gct ttg gaa gcg ccc ctg	3024
Arg Leu Gly Cys Gly Arg Val Glu Glu Leu Ala Leu Glu Ala Pro Leu	
995 1000 1005	
atc ctg ccg gat cat gga gcg gtc cag gtt cag gtg ctg gtg gga ccg	3072
Ile Leu Pro Asp His Gly Ala Val Gln Val Gln Val Leu Val Gly Pro	
1010 1015 1020	
ccc ggg gaa tcc gga gcc cgg tcg gtg gcg ctc tac tcc tgt cct ggc	3120
Pro Gly Glu Ser Gly Ala Arg Ser Val Ala Leu Tyr Ser Cys Pro Gly	
1025 1030 1035 1040	
gag gcg atc gaa ccc gag tgg aag aag cac gcg acg ggc gtg ctt ctc	3168
Glu Ala Ile Glu Pro Glu Trp Lys Lys His Ala Thr Gly Val Leu Leu	
1045 1050 1055	
cca ccc gtg gcc gcc gag aac cat gag ctg acc gca tgg ccc ccg gag	3216
Pro Pro Val Ala Ala Glu Asn His Glu Leu Thr Ala Trp Pro Pro Glu	
1060 1065 1070	
aat gcg acc gaa atc gat gca gac ggg gtc tac gca ttc ctt gaa ggg	3264
Asn Ala Thr Glu Ile Asp Ala Asp Gly Val Tyr Ala Phe Leu Glu Gly	
1075 1080 1085	
cac ggt ttc gcg tac gga ccg gcc ttt aga tgt ctg cgc ggt gcc tgg	3312
His Gly Phe Ala Tyr Gly Pro Ala Phe Arg Cys Leu Arg Gly Ala Trp	
1090 1095 1100	

cga cga ggc ggg gag gtg ttc gcc gaa gtc gca ttg ccg gat gac atg	3360
Arg Arg Gly Gly Glu Val Phe Ala Glu Val Ala Leu Pro Asp Asp Met	
1105 1110 1115 1120	
cag gcg ggg gtc gat cga ttc ggc gtc cac ccc gcg ttg ctg gac gcg	3408
Gln Ala Gly Val Asp Arg Phe Gly Val His Pro Ala Leu Leu Asp Ala	
1125 1130 1135	
gtt ctg cat gcc gcc gca gcc gag acg tcg gtg gtc cag agc gaa gcg	3456
Val Leu His Ala Ala Ala Ala Glu Thr Ser Val Val Gln Ser Glu Ala	
1140 1145 1150	
cgg gtg ccg ttc tcg tgg cgt ggg gtg gaa ctt cgc gcc act gaa agc	3504
Arg Val Pro Phe Ser Trp Arg Gly Val Glu Leu Arg Ala Thr Glu Ser	
1155 1160 1165	
gcg gtg gtg cgg gcg cgc ctc tcg ttg act tcg gat gac gaa ctg tcg	3552
Ala Val Val Arg Ala Arg Leu Ser Leu Thr Ser Asp Asp Glu Leu Ser	
1170 1175 1180	
ttg gtc gca gtg gac ccg gct ggc cga ttc gtg gcc acg gtt gat tcg	3600
Leu Val Ala Val Asp Pro Ala Gly Arg Phe Val Ala Thr Val Asp Ser	
1185 1190 1195 1200	
ctg gtg acc cga ccg atc tcc cgg cag cag gtg agg tct ggc gcg atc	3648
Leu Val Thr Arg Pro Ile Ser Arg Gln Gln Val Arg Ser Gly Ala Ile	
1205 1210 1215	
ggg gat tgc ctg ttc gag gtg gag tgg cac cgg aag gcg ttg ttg gga	3696
Gly Asp Cys Leu Phe Glu Val Glu Trp His Arg Lys Ala Leu Leu Gly	
1220 1225 1230	
aca acc gcc ggc gac gac ctt gcc atc gtc ggt gac ggt ccc agt tgg	3744
Thr Thr Ala Gly Asp Asp Leu Ala Ile Val Gly Asp Gly Pro Ser Trp	
1235 1240 1245	
ccg gaa tcg gtg cgc gca acc gca cgg ttc gcg acc ctg gat gag ttc	3792
Pro Glu Ser Val Arg Ala Thr Ala Arg Phe Ala Thr Leu Asp Glu Phe	
1250 1255 1260	
cgt gcg gcc gtg gac tcg gac gtt cct gcc ccg ggt tcg gtg ttg gtc	3840
Arg Ala Ala Val Asp Ser Asp Val Pro Ala Pro Gly Ser Val Leu Val	
1265 1270 1275 1280	
gca gct atg tcg gcc gaa gag gtc gag ggt gga tcc ctg ccg tcg cgc	3888
Ala Ala Met Ser Ala Glu Glu Val Glu Gly Gly Ser Leu Pro Ser Arg	
1285 1290 1295	

gcc caa gag tgc acc tcc gat ctg ctg gct ctc gtg cag tgc tgg ctt 3936  
 Ala Gln Glu Ser Thr Ser Asp Leu Leu Ala Leu Val Gln Ser Trp Leu  
 1300 1305 1310

gcg gac gag cgg ttc gcc gaa tcc cag ctc gtg gtc gtc acg cgt gca 3984  
 Ala Asp Glu Arg Phe Ala Glu Ser Gln Leu Val Val Val Thr Arg Ala  
 1315 1320 1325

gcg gtg tgc gcc gac tgc gat tgc gac gtc gcg gac ctg gtg ggt gcg 4032  
 Ala Val Ser Ala Asp Ser Asp Ser Asp Val Ala Asp Leu Val Gly Ala  
 1330 1335 1340

tgc tgc tgg ggg ttg ttg agt tca gcc cag tgc gag aac ccg ggt cgc 4080  
 Ser Ser Trp Gly Leu Leu Ser Ser Ala Gln Ser Glu Asn Pro Gly Arg  
 1345 1350 1355 1360

ttc gtg ctg gtg gac gtg gac ggc aca cct gag tgc tgg cag gcg ttg 4128  
 Phe Val Leu Val Asp Val Asp Gly Thr Pro Glu Ser Trp Gln Ala Leu  
 1365 1370 1375

ccg gcc gcc gtg cga gca gga gaa ccg cag ctg gca ctt cgg cgc ggc 4176  
 Pro Ala Ala Val Arg Ala Gly Glu Pro Gln Leu Ala Leu Arg Arg Gly  
 1380 1385 1390

gtg gcg ctg gtg cct cgg ttg gcg cga ctc acg gtg cgc gag gag ggc 4224  
 Val Ala Leu Val Pro Arg Leu Ala Arg Leu Thr Val Arg Glu Glu Gly  
 1395 1400 1405

tcc tcc ccg caa ctc gac acg gac ggg acc gtc ctc atc acg ggt ggc 4272  
 Ser Ser Pro Gln Leu Asp Thr Asp Gly Thr Val Leu Ile Thr Gly Gly  
 1410 1415 1420

acc ggt gcg ttg ggg gga gtg gtt gcc cgt cac ctg gtg gag gag cac 4320  
 Thr Gly Ala Leu Gly Gly Val Val Ala Arg His Leu Val Glu Glu His  
 1425 1430 1435 1440

ggg att ccg cgt ttg gtg ttg gca ggc ccg cgt ggc tgg aat gcg cct 4368  
 Gly Ile Arg Arg Leu Val Leu Ala Gly Arg Arg Gly Trp Asn Ala Pro  
 1445 1450 1455

gga gtc cac gag ttg gtg gat gag ctg gcg cgc gcg ggc gcc gtg gtt 4416  
 Gly Val His Glu Leu Val Asp Glu Leu Ala Arg Ala Gly Ala Val Val  
 1460 1465 1470

gag gtg gtg gct tgc gat gtg gct gac cgc acc gat ctg gag cac gtg 4464  
 Glu Val Val Ala Cys Asp Val Ala Asp Arg Thr Asp Leu Glu His Val  
 1475 1480 1485

ctg gcc gcc att ccg gtc gac tgg ccg ctg cgg ggg atc gtg cat acc	4512
Leu Ala Ala Ile Pro Val Asp Trp Pro Leu Arg Gly Ile Val His Thr	
1490 1495 1500	
gct ggg gtg ctg gcc gac gga gtg atc ggg tcc ttg tcg gcg gcg gat	4560
Ala Gly Val Leu Ala Asp Gly Val Ile Gly Ser Leu Ser Ala Ala Asp	
1505 1510 1515 1520	
gtg ggc acg gtg ttt gcc ccg aag gtg acg ggg gca tgg cat ctg cac	4608
Val Gly Thr Val Phe Ala Pro Lys Val Thr Gly Ala Trp His Leu His	
1525 1530 1535	
gag ttg acc cgc gat ctg gat ctg tcg ttc ttc gtt ctt ttc tct tcc	4656
Glu Leu Thr Arg Asp Leu Asp Leu Ser Phe Phe Val Leu Phe Ser Ser	
1540 1545 1550	
ttc tcc ggg att gcg ggt gcc gca ggg cag gcc aac tac gcg gcg gcg	4704
Phe Ser Gly Ile Ala Gly Ala Ala Gly Gln Ala Asn Tyr Ala Ala Ala	
1555 1560 1565	
aac acg ttc ctg gat gca ttg gcg cgt tat cgc cgg gcg cgt ggg ctg	4752
Asn Thr Phe Leu Asp Ala Leu Ala Arg Tyr Arg Arg Ala Arg Gly Leu	
1570 1575 1580	
cct ggg ttg tcg ttg gcg tgg gga ctg tgg gcg caa ccc agc ggt atg	4800
Pro Gly Leu Ser Leu Ala Trp Gly Leu Trp Ala Gln Pro Ser Gly Met	
1585 1590 1595 1600	
acg agt ggc ttg gac gcg gcg tcg gtg gag cgg ttg gcg cgg acg ggc	4848
Thr Ser Gly Leu Asp Ala Ala Ser Val Glu Arg Leu Ala Arg Thr Gly	
1605 1610 1615	
atc gca gaa ctt tcc acg gag gat gga ctc cgc ctg ttc gat gcc gcg	4896
Ile Ala Glu Leu Ser Thr Glu Asp Gly Leu Arg Leu Phe Asp Ala Ala	
1620 1625 1630	
ttc gcg aag gac cgg gct tgc gtc gtt gcc gct cga ttg gac agg gcg	4944
Phe Ala Lys Asp Arg Ala Cys Val Val Ala Ala Arg Leu Asp Arg Ala	
1635 1640 1645	
ctg ctg gtc ggg aac gga cga tcg cac gcg att ccg gcg ctg ttg agc	4992
Leu Leu Val Gly Asn Gly Arg Ser His Ala Ile Pro Ala Leu Leu Ser	
1650 1655 1660	
gcg ttg gtt cct gtt cgc ggc ggt gtg gcg agg aaa aca gcc aat tct	5040
Ala Leu Val Pro Val Arg Gly Gly Val Ala Arg Lys Thr Ala Asn Ser	
1665 1670 1675 1680	

cag gcc gcg gat gag gac gca ctg ttg ggt ttg gtg cgg gag cac gtt	5088
Gln Ala Ala Asp Glu Asp Ala Leu Leu Gly Leu Val Arg Glu His Val	
1685 1690 1695	
tcg gcc gtg ctg ggt tat tcg ggt gcg gtc gag gtt ggg ggc gac cgt	5136
Ser Ala Val Leu Gly Tyr Ser Gly Ala Val Glu Val Gly Gly Asp Arg	
1700 1705 1710	
gct ttc cgt gat ctg ggt ttt gat tcg ttg tct ggc gtg gag ttg cgg	5184
Ala Phe Arg Asp Leu Gly Phe Asp Ser Leu Ser Gly Val Glu Leu Arg	
1715 1720 1725	
aac cgc ctt gcc ggg gtg ctg ggg gtg cgg ttg ccg gcg act gcg gtg	5232
Asn Arg Leu Ala Gly Val Leu Gly Val Arg Leu Pro Ala Thr Ala Val	
1730 1735 1740	
ttc gac tat ccg acg ccg cgg gcg ctg gcg cgt ttc ctg cat cag gaa	5280
Phe Asp Tyr Pro Thr Pro Arg Ala Leu Ala Arg Phe Leu His Gln Glu	
1745 1750 1755 1760	
ctg gca ggc gag gtc gcg tcc acg tcg acg ccg gtg acc agg gca gcg	5328
Leu Ala Gly Glu Val Ala Ser Thr Ser Thr Pro Val Thr Arg Ala Ala	
1765 1770 1775	
agt gcc gaa gag gat ctt gtt gcg att gtc ggg atg gga tgt cgt ttt	5376
Ser Ala Glu Glu Asp Leu Val Ala Ile Val Gly Met Gly Cys Arg Phe	
1780 1785 1790	
ccg ggt ggg gtg tcg tcg ccg gag gag ctt tgg cgg ctg gtg gcc ggc	5424
Pro Gly Gly Val Ser Ser Pro Glu Glu Leu Trp Arg Leu Val Ala Gly	
1795 1800 1805	
ggc gtg gat gcg gtg gct ggg ttc cca gac gat cgc ggc tgg gat ctc	5472
Gly Val Asp Ala Val Ala Gly Phe Pro Asp Asp Arg Gly Trp Asp Leu	
1810 1815 1820	
gcg gcg ttg tac gat cct gat ccc gat cgt ctc ggg acc tcg tat gtg	5520
Ala Ala Leu Tyr Asp Pro Asp Pro Asp Arg Leu Gly Thr Ser Tyr Val	
1825 1830 1835 1840	
tgt gag ggc ggg ttt ctg cgg gac gcg gcg gag ttc gat gct gac atg	5568
Cys Glu Gly Gly Phe Leu Arg Asp Ala Ala Glu Phe Asp Ala Asp Met	
1845 1850 1855	
ttc ggc atc agc ccg cgt gag gcg ttg gcg atg gat ccg cag cag cgg	5616
Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg	
1860 1865 1870	

ttg ctg ctg gag gtc gcc tgg gaa acc ttg gag cgg gct ggg atc gat	5664
Leu Leu Leu Glu Val Ala Trp Glu Thr Leu Glu Arg Ala Gly Ile Asp	
1875 1880 1885	
ccg ttc tcg ttg cac ggc agc cgg acc ggt gtg ttc gcg ggc ttg atg	5712
Pro Phe Ser Leu His Gly Ser Arg Thr Gly Val Phe Ala Gly Leu Met	
1890 1895 1900	
tac cac gac tat ggg gcc cga ttc att acc aga gca ccg gag ggc ttc	5760
Tyr His Asp Tyr Gly Ala Arg Phe Ile Thr Arg Ala Pro Glu Gly Phe	
1905 1910 1915 1920	
gaa ggg cac ctc ggg acg ggc aat gcg ggg agc gtg ctg tcg ggt cgg	5808
Glu Gly His Leu Gly Thr Gly Asn Ala Gly Ser Val Leu Ser Gly Arg	
1925 1930 1935	
gtt gcg tat tcg ttt ggt ttc gag ggt cct gcg gtg acg gtg gat acg	5856
Val Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr	
1940 1945 1950	
gcg tgt tcg tcg tcg ttg gtg gcg tta cac ctg gcg ggt caa gca ctg	5904
Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ala Leu	
1955 1960 1965	
cgg gcc ggt gag tgc gaa ttc gcc ctt gcc ggt ggc gtc acg gtg atg	5952
Arg Ala Gly Glu Cys Glu Phe Ala Leu Ala Gly Gly Val Thr Val Met	
1970 1975 1980	
tcg acg ccg acg acg ttc gtg gag ttc tcc cgt caa cgg ggt ctg gct	6000
Ser Thr Pro Thr Thr Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala	
1985 1990 1995 2000	
ccg gat ggg cgg tgc aag tcg ttc gcg gcg gcc gcg gat ggc acc ggg	6048
Pro Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala Asp Gly Thr Gly	
2005 2010 2015	
tgg ggc gag ggt gcc ggt ctg gtg ttg ctg gag cgg ttg tcg gat gcc	6096
Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala	
2020 2025 2030	
cgg cgc aat ggg cac gag gtt ctg gcg gtg gtg cgg ggt agc gcg gtg	6144
Arg Arg Asn Gly His Glu Val Leu Ala Val Val Arg Gly Ser Ala Val	
2035 2040 2045	
aac cag gac ggc gcg tcg aat ggc ttg act gcg cca aat ggt ccg tca	6192
Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser	
2050 2055 2060	



cag caa agg gtg atc acc cag gca ctc acg agt gcc ggg ctg tcc gtg	6240
Gln Gln Arg Val Ile Thr Gln Ala Leu Thr Ser Ala Gly Leu Ser Val	
2065                      2070                      2075                      2080	
tcc gac gtg gat gct gtg gag gcg cat ggg acg ggc acg cgg ctt ggt	6288
Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly	
2085                      2090                      2095	
gat ccg atc gag gcg cag gcg ttg atc gct acg tac ggc cgg gat cgt	6336
Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Arg Asp Arg	
2100                      2105                      2110	
gat ccc ggt cgg ccg ttg tgg ctg ggg tcg gtg aag tcg aat att ggt	6384
Asp Pro Gly Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly	
2115                      2120                      2125	
cac acc cag gcg gcg gcg ggt gtc gct ggt gtg atc aag atg gtg atg	6432
His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met	
2130                      2135                      2140	
gcg atg cgg cag ggg gag ctg ccg cgc acg ttg cac gtg gac gag ccc	6480
Ala Met Arg Gln Gly Glu Leu Pro Arg Thr Leu His Val Asp Glu Pro	
2145                      2150                      2155                      2160	
tcc gcg cag gtg gac tgg tct gcg ggc acg gtc caa ctc ctc acg gag	6528
Ser Ala Gln Val Asp Trp Ser Ala Gly Thr Val Gln Leu Leu Thr Glu	
2165                      2170                      2175	
aac acg ccc tgg ccc gac agc ggt cgt ctt cgc cgg gcg ggc gtg tca	6576
Asn Thr Pro Trp Pro Asp Ser Gly Arg Leu Arg Arg Ala Gly Val Ser	
2180                      2185                      2190	
tcg ttc ggg atc agt ggc acc aac gcg cac ctg atc ctt gaa caa cct	6624
Ser Phe Gly Ile Ser Gly Thr Asn Ala His Leu Ile Leu Glu Gln Pro	
2195                      2200                      2205	
ccg cga gag tcg cag cgc tca aca gag ccg gat tcg ggt tct gtc cgc	6672
Pro Arg Glu Ser Gln Arg Ser Thr Glu Pro Asp Ser Gly Ser Val Arg	
2210                      2215                      2220	
gat ttt ccg gtg gtg ccg tgg atg gtg tcg ggc aaa aca ccc gaa gcg	6720
Asp Phe Pro Val Val Pro Trp Met Val Ser Gly Lys Thr Pro Glu Ala	
2225                      2230                      2235                      2240	
cta tcc gcc cag gca gat gca ttg atg tcc tac ttg agc aat cgc gtt	6768
Leu Ser Ala Gln Ala Asp Ala Leu Met Ser Tyr Leu Ser Asn Arg Val	
2245                      2250                      2255	

gat gct tcc ccg cga gat atc ggt tat tcg ctt gcg gtg acc cgt ccg	6816
Asp Ala Ser Pro Arg Asp Ile Gly Tyr Ser Leu Ala Val Thr Arg Pro	
2260 2265 2270	
gcg ttg gac cac cgc gct gtc gtg ctg ggt gcg gat cgt gcc gcg ttg	6864
Ala Leu Asp His Arg Ala Val Val Leu Gly Ala Asp Arg Ala Ala Leu	
2275 2280 2285	
ctg ccg ggc ttg aaa gcg ctg gcc gtt agt aat gac gct gcc gag gtg	6912
Leu Pro Gly Leu Lys Ala Leu Ala Val Ser Asn Asp Ala Ala Glu Val	
2290 2295 2300	
atc acc ggc act cgt gcc gct ggg ccg gtc gga ttc gtg ttc tcc ggt	6960
Ile Thr Gly Thr Arg Ala Ala Gly Pro Val Gly Phe Val Phe Ser Gly	
2305 2310 2315 2320	
caa ggt ggt cag tgg ccc ggg atg gga agc ggg ctc cac tcg gcg ttt	7008
Gln Gly Gly Gln Trp Pro Gly Met Gly Ser Gly Leu His Ser Ala Phe	
2325 2330 2335	
ccg gtg ttc gcc gac gcg ttt gac gaa gcc tgc tgc gag ctg gat gcg	7056
Pro Val Phe Ala Asp Ala Phe Asp Glu Ala Cys Cys Glu Leu Asp Ala	
2340 2345 2350	
cat ctc ggg cag atg gcc cgg cta cga gat gtg ttg tcc ggt tcg gat	7104
His Leu Gly Gln Met Ala Arg Leu Arg Asp Val Leu Ser Gly Ser Asp	
2355 2360 2365	
acg caa ctt ctg gac cag acc ttg tgg gcg cag ccg ggc ctg ttc gcg	7152
Thr Gln Leu Leu Asp Gln Thr Leu Trp Ala Gln Pro Gly Leu Phe Ala	
2370 2375 2380	
ttg caa gtc gga ctc tgg gag ttg ttg ggt tcg tgg ggt gtc cgg ccc	7200
Leu Gln Val Gly Leu Trp Glu Leu Leu Gly Ser Trp Gly Val Arg Pro	
2385 2390 2395 2400	
gct gtg gtg ctg ggc cac tcg gtc ggt gag ctg gcg gcg gcg ttc gcg	7248
Ala Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Ala Phe Ala	
2405 2410 2415	
gct gga gtg ttg tcg ttg cgg gat gcg gct cgg ctg gtg gcg ggc cgt	7296
Ala Gly Val Leu Ser Leu Arg Asp Ala Ala Arg Leu Val Ala Gly Arg	
2420 2425 2430	
gcc cgg ttg atg caa gcc ctg cca act ggc ggt gcc atg ctc gct gcg	7344
Ala Arg Leu Met Gln Ala Leu Pro Thr Gly Gly Ala Met Leu Ala Ala	
2435 2440 2445	

gct gct gga gag gag cag ctg cgc ccg ttg ctg gcc gac tgc ggt gat	7392
Ala Ala Gly Glu Glu Gln Leu Arg Pro Leu Leu Ala Asp Cys Gly Asp	
2450 2455 2460	
cggtgtggg atc gcc gcg gtc aac gct ccc ggg tcg gtg gtg ctc tcc	7440
Arg Val Gly Ile Ala Ala Val Asn Ala Pro Gly Ser Val Val Leu Ser	
2465 2470 2475 2480	
ggt gat cgg gat gtg ctc gat gac att gcc ggt cgg ctg gac ggg caa	7488
Gly Asp Arg Asp Val Leu Asp Asp Ile Ala Gly Arg Leu Asp Gly Gln	
2485 2490 2495	
ggg atc cgg tcc agg tgg ttg cgg gtt tcg cat gcg ttt cat tcg cat	7536
Gly Ile Arg Ser Arg Trp Leu Arg Val Ser His Ala Phe His Ser His	
2500 2505 2510	
cgg atg gat ccg atg ctg gcg gag ttc acc gaa atc gcc cgg agc gtg	7584
Arg Met Asp Pro Met Leu Ala Glu Phe Thr Glu Ile Ala Arg Ser Val	
2515 2520 2525	
gac tac cgg tcg tca ggg ctg ccg atc gtg tcg acg ttg acg ggt gag	7632
Asp Tyr Arg Ser Ser Gly Leu Pro Ile Val Ser Thr Leu Thr Gly Glu	
2530 2535 2540	
ctc gat gag gtc gcc atg ccg gct acg ccg gag tat tgg gtg cgc cag	7680
Leu Asp Glu Val Gly Met Pro Ala Thr Pro Glu Tyr Trp Val Arg Gln	
2545 2550 2555 2560	
gtg cga gaa ccc gtc cgc ttc gcc gac ggt gtt gct gcg ctc gcg gct	7728
Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Ala Ala Leu Ala Ala	
2565 2570 2575	
cac ggt gtg agc acc gtc gtc gag gtc ggt ccg gat ggg gtg ttg tcg	7776
His Gly Val Ser Thr Val Val Glu Val Gly Pro Asp Gly Val Leu Ser	
2580 2585 2590	
gcg ctg gtg cag gag tgc gcg gcc gga tcc gat cag gcc gga cgg gtg	7824
Ala Leu Val Gln Glu Cys Ala Ala Gly Ser Asp Gln Gly Gly Arg Val	
2595 2600 2605	
gcc gcg gtt ccg ctc atg cgc agc aat cgc gac gag gcg cac acg gtg	7872
Ala Ala Val Pro Leu Met Arg Ser Asn Arg Asp Glu Ala His Thr Val	
2610 2615 2620	
aca acg gca ttg gcg cag atc cat gtg cgt ggt gct gag gtg gac tgg	7920
Thr Thr Ala Leu Ala Gln Ile His Val Arg Gly Ala Glu Val Asp Trp	
2625 2630 2635 2640	

cgg tcg ttt ttc gcc ggt acc ggg gca aag cag gtc gag ctg ccc acg	7968
Arg Ser Phe Phe Ala Gly Thr Gly Ala Lys Gln Val Glu Leu Pro Thr	
2645 2650 2655	
tat gcc ttc caa cga cag cgg tac tgg ctt gac tca cca tcc gaa ccg	8016
Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Asp Ser Pro Ser Glu Pro	
2660 2665 2670	
gtc ggg caa tcc gcc gat ccc gcg cgc cag tcg ggc ttc tgg gaa ctc	8064
Val Gly Gln Ser Ala Asp Pro Ala Arg Gln Ser Gly Phe Trp Glu Leu	
2675 2680 2685	
gtc gag cag gaa gat gtc agc gcg ctc agc gcc gct ctg cac att acc	8112
Val Glu Gln Glu Asp Val Ser Ala Leu Ser Ala Ala Leu His Ile Thr	
2690 2695 2700	
ggc gat cac gac gtg cag gcg tcc ctg gaa tcg gtg gtt ccg gtc ctc	8160
Gly Asp His Asp Val Gln Ala Ser Leu Glu Ser Val Val Pro Val Leu	
2705 2710 2715 2720	
tcc tcc tgg cat cgc cgg atc cgc aac gaa tcc ctg gtg cac cag tgg	8208
Ser Ser Trp His Arg Arg Ile Arg Asn Glu Ser Leu Val His Gln Trp	
2725 2730 2735	
cgg tac cgg att tcc tgg cat gag cgg gca gat ttg cca gac ccc tcg	8256
Arg Tyr Arg Ile Ser Trp His Glu Arg Ala Asp Leu Pro Asp Pro Ser	
2740 2745 2750	
ttg tcg ggg aca tgg ctc gtc gtc gtg ccg gag ggg tgg tcg gcg agt	8304
Leu Ser Gly Thr Trp Leu Val Val Val Pro Glu Gly Trp Ser Ala Ser	
2755 2760 2765	
cgg caa gtt ctg cgt ttc aac gag atg ttc gag gaa cgg ggt tgc ccg	8352
Arg Gln Val Leu Arg Phe Asn Glu Met Phe Glu Glu Arg Gly Cys Pro	
2770 2775 2780	
gca gtt ctg ttc gag ctc gcc ggg cac gac gag gaa gcc ctg gcg caa	8400
Ala Val Leu Phe Glu Leu Ala Gly His Asp Glu Glu Ala Leu Ala Gln	
2785 2790 2795 2800	
cga ttc cgc tcg ttg cct gtt gcg tca ggg gga ata agc ggc gtg ttg	8448
Arg Phe Arg Ser Leu Pro Val Ala Ser Gly Gly Ile Ser Gly Val Leu	
2805 2810 2815	
tcc ttg ctg gcg ctg gat gaa tcg ccg tcc tcg ccg aac gct gct ttg	8496
Ser Leu Leu Ala Leu Asp Glu Ser Pro Ser Ser Pro Asn Ala Ala Leu	
2820 2825 2830	

ccg aat ggc gcg ctg aac tcg ttg gta ctg ctg cga gct ctg cgg gcc 8544  
 Pro Asn Gly Ala Leu Asn Ser Leu Val Leu Leu Arg Ala Leu Arg Ala  
 2835 2840 2845

gcg gat gtg tcg gcg cca ttg tgg ttg gcg acg tgt ggt ggt gtc gcg 8592  
 Ala Asp Val Ser Ala Pro Leu Trp Leu Ala Thr Cys Gly Gly Val Ala  
 2850 2855 2860

gtc ggg gat gtg ccg gtg aac ccg ggg cag gcg ctg gtg tgg gga ctg 8640  
 Val Gly Asp Val Pro Val Asn Pro Gly Gln Ala Leu Val Trp Gly Leu  
 2865 2870 2875 2880

ggt cgc gtc gtc ggt ctg gag cat ccg gcc tgg tgg ggt ggc ctg gtc 8688  
 Gly Arg Val Val Gly Leu Glu His Pro Ala Trp Trp Gly Gly Leu Val  
 2885 2890 2895

gac gtg ccg tgc ttg ctc gat gag gac gct cga gaa cgc ttg tcg gtc 8736  
 Asp Val Pro Cys Leu Leu Asp Glu Asp Ala Arg Glu Arg Leu Ser Val  
 2900 2905 2910

gtg ttg gca ggt ctt ggc gag gac gag atc gcg gta cgt ccc ggt ggt 8784  
 Val Leu Ala Gly Leu Gly Glu Asp Glu Ile Ala Val Arg Pro Gly Gly  
 2915 2920 2925

gtg ttc gtg cgg cgg ttg gaa cgc gct ggt gcg gcg tcg ggt gcc ggg 8832  
 Val Phe Val Arg Arg Leu Glu Arg Ala Gly Ala Ala Ser Gly Ala Gly  
 2930 2935 2940

tcg gtg tgg cgt cct cgg ggg acg gtg ttg gtg acg ggt ggt acg ggc 8880  
 Ser Val Trp Arg Pro Arg Gly Thr Val Leu Val Thr Gly Gly Thr Gly  
 2945 2950 2955 2960

ggt ttg ggg gcg cat gtt gcc cgg tgg ttg gcg ggt gcc ggg gct gag 8928  
 Gly Leu Gly Ala His Val Ala Arg Trp Leu Ala Gly Ala Gly Ala Glu  
 2965 2970 2975

cat gtg gtg ttg acc agc cgt cga ggc gcg gcg gct ccg ggc gct gga 8976  
 His Val Val Leu Thr Ser Arg Arg Gly Ala Ala Ala Pro Gly Ala Gly  
 2980 2985 2990

gat ttg cgg gcg gag ctg gag gcg ctg ggc gct cgg gtt tcg atc acg 9024  
 Asp Leu Arg Ala Glu Leu Glu Ala Leu Gly Ala Arg Val Ser Ile Thr  
 2995 3000 3005

gcc tgc gac gtg gcc gat cgt gac gct ttg gcc gaa gtg ttg gcg acc 9072  
 Ala Cys Asp Val Ala Asp Arg Asp Ala Leu Ala Glu Val Leu Ala Thr  
 3010 3015 3020

att ccg gat gat tgc ccg ctg acc gcg gtg atg cat gcg gcg ggg gtc	9120
Ile Pro Asp Asp Cys Pro Leu Thr Ala Val Met His Ala Ala Gly Val	
3025                      3030                      3035                      3040	
ggt gaa gtc ggc gac gtg gcg tcg atg tgt ttg acc gac ttc gtt ggg	9168
Val Glu Val Gly Asp Val Ala Ser Met Cys Leu Thr Asp Phe Val Gly	
3045                      3050                      3055	
gtg ctg tcg gcg aag gca ggt ggt gcg gcg aat ctc gat gag ttg ctc	9216
Val Leu Ser Ala Lys Ala Gly Gly Ala Ala Asn Leu Asp Glu Leu Leu	
3060                      3065                      3070	
gcc gat gtc gag ctg gat gcc ttc gtg ctg ttc tca tcc gtc tcg ggt	9264
Ala Asp Val Glu Leu Asp Ala Phe Val Leu Phe Ser Ser Val Ser Gly	
3075                      3080                      3085	
gtg tgg ggt gct ggc ggg cag ggc gct tat gcg gcg gcg aat gcc tac	9312
Val Trp Gly Ala Gly Gly Gln Gly Ala Tyr Ala Ala Asn Ala Tyr	
3090                      3095                      3100	
ttg gat gcg ttg gcg cag cag cgt cgg gca agg ggg ttg gtg ggg act	9360
Leu Asp Ala Leu Ala Gln Gln Arg Arg Ala Arg Gly Leu Val Gly Thr	
3105                      3110                      3115                      3120	
gcg gtt gcg tgg ggc ccg tgg gcc ggt gac gga atg gcc gca ggt gaa	9408
Ala Val Ala Trp Gly Pro Trp Ala Gly Asp Gly Met Ala Ala Gly Glu	
3125                      3130                      3135	
ggc ggt gca cag ctg cgc cgg gcc ggc ctg gtg cca atg gct gcg gat	9456
Gly Gly Ala Gln Leu Arg Arg Ala Gly Leu Val Pro Met Ala Ala Asp	
3140                      3145                      3150	
cgg gcg ttg ctg gca ctt cag ggc gca ttg gat cgt gac gag aca tcc	9504
Arg Ala Leu Leu Ala Leu Gln Gly Ala Leu Asp Arg Asp Glu Thr Ser	
3155                      3160                      3165	
ctg gtc gtg gcc gat atg gcg tgg gag agg ttc gcc ccg gtg ttc gcc	9552
Leu Val Val Ala Asp Met Ala Trp Glu Arg Phe Ala Pro Val Phe Ala	
3170                      3175                      3180	
atg tcc cgt cgg cgt ccg ctg ctc gac gag ctg ccc gaa gca cag cag	9600
Met Ser Arg Arg Arg Pro Leu Leu Asp Glu Leu Pro Glu Ala Gln Gln	
3185                      3190                      3195                      3200	
gcg ttg gcg gat gcg gag aac acc act gat gct gcg gac tcg gcc gtc	9648
Ala Leu Ala Asp Ala Glu Asn Thr Thr Asp Ala Ala Asp Ser Ala Val	
3205                      3210                      3215	

ccg cta ccg cgg ctg gcg ggc atg gca gcc gcc gaa cgc cgc cgc gcg	9696
Pro Leu Pro Arg Leu Ala Gly Met Ala Ala Ala Glu Arg Arg Arg Ala	
3220 3225 3230	
atg ctg gac ctg gtg ctg gcg gag gcc tcg att gtg ttg gga cac aac	9744
Met Leu Asp Leu Val Leu Ala Glu Ala Ser Ile Val Leu Gly His Asn	
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Gly Ser Asp Pro Val Gly Pro Asp Arg Ala Phe Gln Glu Leu Gly Phe	
3250 3255 3260	
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Asp Ser Leu Met Ala Val Glu Leu Arg Asn Arg Leu Gly Glu Ala Thr	
3265 3270 3275 3280	
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Ala Leu Ala Glu Gln Leu Val Gly Glu Leu Val Gly Ala Gln Pro Ala	
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Thr Thr Val Val Ala Gly Ala Asp Pro Val Asp Asp Pro Val Val Val	
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Val Ala Met Gly Cys Arg Tyr Pro Gly Asp Val Cys Ser Pro Glu Glu	
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Leu Trp Gln Leu Val Ser Ala Gly Arg Asp Ala Val Ser Thr Phe Pro	
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Val Asp Arg Gly Trp Asp Cys Asn Thr Leu Phe Asp Pro Asp Pro Asp	
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Arg Ala Gly Ser Thr Tyr Val Arg Glu Gly Ala Phe Leu Thr Gly Ala	
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Asp Arg Phe Asp Ala Gly Phe Phe Gly Ile Ser Pro Arg Glu Ala Arg	
3395 3400 3405	

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Ala Met Asp Pro Gln Gln Arg Leu Leu Leu Glu Val Ala Trp Glu Val	
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Phe Glu Arg Ala Gly Ile Ala Pro Leu Ser Leu Arg Gly Ser Arg Thr	
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Gly Val Phe Ala Gly Thr Asn Gly Gln Asp His Gly Ala Lys Val Ala	
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gcc gcg ccg gag gcg gcg ggt cac ctc ctg acc gga aac gcc gcg agt	10416
Ala Ala Pro Glu Ala Ala Gly His Leu Leu Thr Gly Asn Ala Ala Ser	
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Val Leu Ala Gly Arg Leu Ser Tyr Thr Phe Gly Leu Glu Gly Pro Ala	
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Val Ala Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu	
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Gly Val Thr Val Met Ser Thr Pro Leu Ala Phe Leu Glu Phe Ser Arg	
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Gln Arg Gly Leu Ala Pro Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala	
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Ala Asp Gly Thr Gly Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu	
3555 3560 3565	
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Arg Leu Ser Asp Ala Arg Arg Asn Gly His Arg Val Leu Ala Val Val	
3570 3575 3580	
cgc ggg tct gcg gtg aat cag gat ggt gcg tgc aat ggc ctg act gcg	10800
Arg Gly Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala	
3585 3590 3595 3600	



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Pro Asn Gly Pro Ser Gln Gln Arg Val Ile Arg Gln Ala Leu Ala Asn	
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gcg ggg ctg tcg gcg tcc gat gtg gat gtc gtg gag gcg cac ggg acc	10896
Ala Gly Leu Ser Ala Ser Asp Val Asp Val Val Glu Ala His Gly Thr	
3620 3625 3630	
ggt acc ggg ctc ggg gat ccg atc gag gcg cag gcg ctg atc gcg aca	10944
Gly Thr Gly Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr	
3635 3640 3645	
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Tyr Gly Gln Glu Arg Asp Pro Glu Arg Ala Leu Trp Leu Gly Ser Ile	
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Lys Ser Asn Ile Gly His Thr Gln Ala Ala Ala Gly Val Ala Gly Val	
3665 3670 3675 3680	
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Ile Lys Met Val Gln Ala Met Arg His Gly Glu Leu Pro Ala Thr Leu	
3685 3690 3695	
cac gtg gac aag ccc act cca cag gtg gac tgg tct gcc ggg gcc gtt	11136
His Val Asp Lys Pro Thr Pro Gln Val Asp Trp Ser Ala Gly Ala Val	
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Arg Leu Leu Thr Gly Asn Thr Pro Trp Pro Glu Ser Gly Arg Pro Arg	
3715 3720 3725	
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Arg Ala Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn Ala His Leu	
3730 3735 3740	
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Ile Leu Glu Gln Pro Pro Ser Glu Pro Ala Glu Ile Asp Gln Ser Asp	
3745 3750 3755 3760	
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Arg Arg Val Thr Ala His Pro Ala Val Ile Pro Trp Met Leu Ser Ala	
3765 3770 3775	
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Arg Ser Leu Ala Ala Leu Gln Ala Gln Ala Ala Ala Leu Gln Ala Arg	
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Leu Asp Arg Gly Pro Gly Ala Ser Pro Leu Asp Leu Gly Tyr Ser Leu	
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Ala Thr Thr Arg Ser Val Leu Asp Glu Arg Ala Val Val Trp Gly Ala	
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Asp Arg Glu Ala Leu Leu Ser Arg Leu Ala Ala Leu Ala Asp Gly Arg	
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Thr Ala Pro Gly Val Ile Thr Gly Ser Ala Asn Ser Gly Gly Arg Ile	
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Ala Leu Cys Ala Ala Phe Pro Ala Phe Ala Asp Ala Phe Glu Glu Ala	
3875 3880 3885	
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Cys Asp Ala Leu Ser Ala His Leu Gly Ala Asp Val Arg Gly Val Leu	
3890 3895 3900	
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Phe Gly Ala Asp Glu Gln Met Leu Asp Arg Thr Leu Trp Ala Gln Ser	
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Gly Ile Phe Ala Val Gln Val Gly Leu Leu Gly Leu Leu Arg Ser Trp	
3925 3930 3935	
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Gly Val Arg Pro Ala Ala Val Leu Gly His Ser Val Gly Glu Leu Ala	
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Ala Ala His Ala Ala Gly Val Leu Ser Leu Pro Asp Ala Ala Arg Leu	
3955 3960 3965	
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Val Ala Ala Arg Ala His Leu Met Gln Ala Leu Pro Thr Gly Gly Ala	
3970 3975 3980	

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Met Leu Ala Val Ala Thr Ser Glu Ala Ala Val Gly Pro Leu Leu Ser	
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Gly Val Cys Asp Arg Val Ser Ile Ala Ala Ile Asn Gly Pro Glu Ser	
4005                      4010                      4015	
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Val Val Leu Ser Gly Asp Arg Asp Val Leu Val Glu Leu Ala Gly Glu	
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Phe Asp Ala Arg Gly Leu Arg Thr Lys Trp Leu Arg Val Ser His Ala	
4035                      4040                      4045	
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Phe His Ser His Arg Met Glu Pro Ile Leu Asp Glu Tyr Ala Glu Thr	
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Ala Arg Cys Val Glu Phe Gly Glu Pro Val Val Pro Ile Val Ser Ala	
4065                      4070                      4075                      4080	
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Ala Thr Gly Ala Leu Asp Thr Thr Gly Leu Met Cys Ala Ala Asp Tyr	
4085                      4090                      4095	
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Trp Thr Arg Gln Val Arg Asp Pro Val Arg Phe Gly Asp Gly Val Arg	
4100                      4105                      4110	
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Ala Leu Val Gly Gln Gly Val Asp Thr Ile Val Glu Phe Gly Pro Asp	
4115                      4120                      4125	
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Gly Ala Leu Ser Ala Leu Val Glu Gln Cys Leu Ala Gly Ser Asp Gln	
4130                      4135                      4140	
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Ala Gly Arg Val Ala Ala Ile Pro Leu Met Arg Arg Asp Arg Asp Glu	
4145                      4150                      4155                      4160	
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Val Glu Thr Ala Val Ala Ala Leu Ala His Val His Val Arg Gly Gly	
4165                      4170                      4175	

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Gln Ala Asp Gly Arg Gly Gly Asp Val Val Ala Asp Pro Val Asp Ala	
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Arg Phe Trp Glu Leu Val Glu Arg Ala Asp Pro Glu Pro Leu Val Asp	
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Glu Leu Cys Ile Asp Arg Asp Gln Pro Phe Arg Glu Val Leu Pro Val	
4245 4250 4255	
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4340 4345 4350	
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Val Leu Ser Leu Leu Ala Met Asp Gly Met Pro Cys Ala Ala His Pro	
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His Leu Ser Arg Gly Val Ala Ala Thr Val Ile Leu Thr Gln Val Leu	
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Gly Asp Ala Gly Val Ser Ala Pro Leu Trp Leu Ala Thr Thr Gly Gly	
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Val Glu Ala Gly Thr Glu Asp Gly Pro Ala Asp Pro Asp His Gly Leu	
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Ile Trp Gly Leu Gly Arg Val Val Gly Leu Glu His Pro Gln Trp Trp	
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Val Arg Ser Ser Gly Leu Phe Val Arg Arg Val Val Arg Ala Ala Arg	
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Asn Pro Arg Ser Glu Thr Trp Arg Ser Arg Gly Thr Val Leu Ile Thr	
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Pro Gly Ala Ala Asp Leu Gly Ala Glu Leu Thr Glu Leu Gly Val Lys	
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 4785 4790 4795 4800

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 Phe Asp Ser Leu Thr Ala Val Glu Leu Arg Asn Arg Leu Asn Ala Val  
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 Thr Gly Leu Arg Leu Pro Pro Thr Leu Val Phe Asp His Pro Thr Pro  
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 Asn Gly Ile Glu Ser Leu Leu Ala Glu Leu Asp Arg Leu Asp Thr Thr  
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 Glu Arg Leu His Ala Leu Leu Ala Lys Trp Asp Gly Ala Arg Asp Gly  
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 4900 4905 4910

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 Glu Ile Phe Asp Leu Ile Asp Arg Lys Phe Arg Arg  
 4915 4920

&lt;210&gt; 48

&lt;211&gt; 4924

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 48

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Asp Leu His Gln Thr Arg Gln Arg Leu Leu Ala Ala Glu Ser Arg Ser  
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Gln Glu Pro Ile Ala Ile Val Ser Ala Ser Cys Arg Leu Pro Gly Gly  
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Val Asp Ser Pro Glu Ala Leu Trp Gln Leu Val Arg Thr Gly Thr Asp  
 50 55 60

Ala Ile Ser Glu Phe Pro Ala Asp Arg Gly Trp Asp Leu Gly Arg Leu  
 65 70 75 80

Tyr Asp Pro Asp Pro Asn His Gln Gly Thr Ser Tyr Thr Arg Ala Gly  
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Gly Phe Leu Ala Gly Ala Gly Asp Phe Asp Pro Ala Met Phe Gly Ile  
 100 105 110

Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu  
 115 120 125

Glu Leu Ser Trp Glu Ala Leu Glu Arg Ala Gly Ile Asp Pro Thr Ser  
 130 135 140

Leu Arg Gly Ser Lys Thr Gly Val Phe Gly Gly Val Thr Pro Gln Glu  
 145 150 155 160

Tyr Gly Pro Ser Leu Gln Glu Met Ser Arg Asn Ala Gly Gly Phe Gly  
 165 170 175

Leu Thr Gly Arg Met Val Ser Val Ala Ser Gly Arg Val Ala Tyr Ser  
 180 185 190

Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser  
 195 200 205

Ser Leu Val Ala Leu His Leu Ala Cys Gln Ser Leu Arg Ser Gly Glu  
 210 215 220

Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val Met Ala Thr Pro Ala  
 225 230 235 240



Thr Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala Pro Asp Gly Arg  
 245 250 255  
 Cys Lys Ser Phe Ala Ala Ala Ala Asp Gly Thr Gly Trp Gly Glu Gly  
 260 265 270  
 Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly  
 275 280 285  
 His Glu Val Leu Ala Val Val Arg Gly Ser Ala Val Asn Gln Asp Gly  
 290 295 300  
 Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser Gln Gln Arg Val  
 305 310 315 320  
 Ile Thr Gln Ala Leu Ala Ser Ala Gly Leu Ser Val Ser Asp Val Asp  
 325 330 335  
 Ala Val Glu Ala His Gly Thr Gly Thr Thr Leu Gly Asp Pro Ile Glu  
 340 345 350  
 Ala Gln Ala Leu Ile Ala Thr Tyr Gly Gln Gly Arg Glu Lys Asp Arg  
 355 360 365  
 Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly His Thr Gln Ala  
 370 375 380  
 Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Leu Ala Met Arg His  
 385 390 395 400  
 Gly Gln Leu Pro Ala Thr Leu His Val Asp Glu Pro Thr Ser Ala Val  
 405 410 415  
 Asp Trp Ser Ala Gly Ser Val Arg Leu Leu Thr Glu Asn Thr Pro Trp  
 420 425 430  
 Pro Asp Ser Gly Arg Pro Cys Arg Val Gly Val Ser Ser Phe Gly Ile  
 435 440 445  
 Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Ser Pro Val Glu Gln  
 450 455 460  
 Gly Glu Pro Ala Gly Pro Val Glu Gly Glu Arg Glu Pro Asp Val Ala  
 465 470 475 480  
 Val Pro Val Val Pro Trp Val Leu Ser Gly Lys Thr Pro Glu Ala Ala  
 485 490 495

Arg Ala Gln Ala Glu Arg Val His Ser His Ile Glu Asp Arg Pro Gly  
 500 505 510

Leu Ser Pro Val Asp Val Ala Tyr Ser Leu Gly Met Thr Arg Ala Ala  
 515 520 525

Leu Asp Glu Arg Ala Val Val Leu Gly Ser Asp Arg Ala Ala Leu Leu  
 530 535 540

Thr Gly Leu Arg Ala Phe Ala Asp Gly Cys Asp Ala Pro Glu Val Val  
 545 550 555 560

Ser Gly Ser Val Gly Leu Gly Gly Arg Val Gly Phe Val Phe Ser Gly  
 565 570 575

Gln Gly Gly Gln Trp Pro Gly Met Gly Arg Gly Leu Tyr Ser Val Phe  
 580 585 590

Pro Val Phe Ala Asp Ala Phe Asp Glu Ala Cys Ala Glu Leu Asp Ala  
 595 600 605

His Leu Gly Gln Glu Leu Arg Val Arg Asp Val Val Phe Gly Ser Gln  
 610 615 620

Ala Trp Leu Leu Asp Arg Thr Val Trp Ala Gln Ser Gly Leu Phe Ala  
 625 630 635 640

Leu Gln Ile Gly Leu Leu Arg Leu Leu Gly Ser Trp Gly Val Arg Pro  
 645 650 655

Asp Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Val His Ala  
 660 665 670

Ala Gly Val Leu Ser Leu Ser Glu Ala Ala Arg Leu Val Ala Gly Arg  
 675 680 685

Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Ala Met Leu Ala Val  
 690 695 700

Ala Thr Gly Glu Phe Gln Val Asp Pro Leu Leu Asp Gly Val Arg Asp  
 705 710 715 720

Arg Ile Gly Ile Ala Ala Val Asn Gly Pro Glu Ser Val Val Leu Ser  
 725 730 735

Gly Asp Arg Glu Leu Leu Thr Glu Ile Ala Asp Arg Leu His Asp Gln  
 740 745 750

Gly Cys Arg Thr Arg Trp Leu Arg Val Ser His Ala Phe His Ser Pro  
 755 760 765

His Met Glu Pro Met Leu Glu Glu Phe Ala Gln Ile Ser Arg Gly Arg  
 770 775 780

Glu Tyr His Ala Pro Glu Leu Pro Ile Ile Ser Thr Leu Ile Gly Glu  
 785 790 795 800

Leu Asp Gly Gly Arg Val Met Gly Thr Pro Glu Tyr Trp Val Arg Gln  
 805 810 815

Val Arg Glu Pro Val Arg Phe Ala Glu Gly Val Gln Ala Leu Val Gly  
 820 825 830

Gln Gly Val Gly Thr Ile Val Glu Leu Gly Pro Asp Gly Ala Leu Ser  
 835 840 845

Thr Leu Val Glu Glu Cys Val Ala Glu Ser Gly Arg Val Ala Gly Ile  
 850 855 860

Pro Leu Met Arg Lys Asp Arg Asp Glu Ala Arg Thr Val Leu Ala Ala  
 865 870 875 880

Leu Ala Gln Ile His Thr Arg Gly Gly Glu Val Asp Trp Arg Ser Phe  
 885 890 895

Phe Ala Gly Thr Gly Ala Lys Gln Val Asp Leu Pro Thr Tyr Ala Phe  
 900 905 910

Gln Arg Gln Arg Tyr Trp Leu Ala Ser Thr Gly Arg Ala Gly Asp Val  
 915 920 925

Thr Ala Ala Gly Leu Ala Glu Ala Asp His Pro Leu Leu Gly Ala Val  
 930 935 940

Val Ala Leu Ala Asp Gly Glu Gly Val Val Leu Thr Gly Arg Leu Thr  
 945 950 955 960

Ala Gly Ser His Pro Trp Leu Ser Asp His Arg Val Leu Gly Glu Ile  
 965 970 975

Val Val Pro Gly Thr Ala Ile Val Glu Leu Val Trp His Val Gly Glu  
 980 985 990

Arg Leu Gly Cys Gly Arg Val Glu Glu Leu Ala Leu Glu Ala Pro Leu  
 995 1000 1005

Ile Leu Pro Asp His Gly Ala Val Gln Val Gln Val Leu Val Gly Pro  
 1010 1015 1020

Pro Gly Glu Ser Gly Ala Arg Ser Val Ala Leu Tyr Ser Cys Pro Gly  
 025 1030 1035 1040

Glu Ala Ile Glu Pro Glu Trp Lys Lys His Ala Thr Gly Val Leu Leu  
 1045 1050 1055

Pro Pro Val Ala Ala Glu Asn His Glu Leu Thr Ala Trp Pro Pro Glu  
 1060 1065 1070

Asn Ala Thr Glu Ile Asp Ala Asp Gly Val Tyr Ala Phe Leu Glu Gly  
 1075 1080 1085

His Gly Phe Ala Tyr Gly Pro Ala Phe Arg Cys Leu Arg Gly Ala Trp  
 1090 1095 1100

Arg Arg Gly Gly Glu Val Phe Ala Glu Val Ala Leu Pro Asp Asp Met  
 105 1110 1115 1120

Gln Ala Gly Val Asp Arg Phe Gly Val His Pro Ala Leu Leu Asp Ala  
 1125 1130 1135

Val Leu His Ala Ala Ala Ala Glu Thr Ser Val Val Gln Ser Glu Ala  
 1140 1145 1150

Arg Val Pro Phe Ser Trp Arg Gly Val Glu Leu Arg Ala Thr Glu Ser  
 1155 1160 1165

Ala Val Val Arg Ala Arg Leu Ser Leu Thr Ser Asp Asp Glu Leu Ser  
 1170 1175 1180

Leu Val Ala Val Asp Pro Ala Gly Arg Phe Val Ala Thr Val Asp Ser  
 185 1190 1195 1200

Leu Val Thr Arg Pro Ile Ser Arg Gln Gln Val Arg Ser Gly Ala Ile  
 1205 1210 1215

Gly Asp Cys Leu Phe Glu Val Glu Trp His Arg Lys Ala Leu Leu Gly  
 1220 1225 1230

Thr Thr Ala Gly Asp Asp Leu Ala Ile Val Gly Asp Gly Pro Ser Trp  
 1235 1240 1245

Pro Glu Ser Val Arg Ala Thr Ala Arg Phe Ala Thr Leu Asp Glu Phe  
 1250 1255 1260

Arg Ala Ala Val Asp Ser Asp Val Pro Ala Pro Gly Ser Val Leu Val  
 265 1270 1275 1280

Ala Ala Met Ser Ala Glu Glu Val Glu Gly Gly Ser Leu Pro Ser Arg  
 1285 1290 1295

Ala Gln Glu Ser Thr Ser Asp Leu Leu Ala Leu Val Gln Ser Trp Leu  
 1300 1305 1310

Ala Asp Glu Arg Phe Ala Glu Ser Gln Leu Val Val Val Thr Arg Ala  
 1315 1320 1325

Ala Val Ser Ala Asp Ser Asp Ser Asp Val Ala Asp Leu Val Gly Ala  
 1330 1335 1340

Ser Ser Trp Gly Leu Leu Ser Ser Ala Gln Ser Glu Asn Pro Gly Arg  
 345 1350 1355 1360

Phe Val Leu Val Asp Val Asp Gly Thr Pro Glu Ser Trp Gln Ala Leu  
 1365 1370 1375

Pro Ala Ala Val Arg Ala Gly Glu Pro Gln Leu Ala Leu Arg Arg Gly  
 1380 1385 1390

Val Ala Leu Val Pro Arg Leu Ala Arg Leu Thr Val Arg Glu Glu Gly  
 1395 1400 1405

Ser Ser Pro Gln Leu Asp Thr Asp Gly Thr Val Leu Ile Thr Gly Gly  
 1410 1415 1420

Thr Gly Ala Leu Gly Gly Val Val Ala Arg His Leu Val Glu Glu His  
 425 1430 1435 1440

Gly Ile Arg Arg Leu Val Leu Ala Gly Arg Arg Gly Trp Asn Ala Pro  
 1445 1450 1455

Gly Val His Glu Leu Val Asp Glu Leu Ala Arg Ala Gly Ala Val Val  
 1460 1465 1470

Glu Val Val Ala Cys Asp Val Ala Asp Arg Thr Asp Leu Glu His Val  
 1475 1480 1485

Leu Ala Ala Ile Pro Val Asp Trp Pro Leu Arg Gly Ile Val His Thr  
 1490 1495 1500

Ala Gly Val Leu Ala Asp Gly Val Ile Gly Ser Leu Ser Ala Ala Asp  
 505 1510 1515 1520

Val Gly Thr Val Phe Ala Pro Lys Val Thr Gly Ala Trp His Leu His  
 1525 1530 1535  
 Glu Leu Thr Arg Asp Leu Asp Leu Ser Phe Phe Val Leu Phe Ser Ser  
 1540 1545 1550  
 Phe Ser Gly Ile Ala Gly Ala Ala Gly Gln Ala Asn Tyr Ala Ala Ala  
 1555 1560 1565  
 Asn Thr Phe Leu Asp Ala Leu Ala Arg Tyr Arg Arg Ala Arg Gly Leu  
 1570 1575 1580  
 Pro Gly Leu Ser Leu Ala Trp Gly Leu Trp Ala Gln Pro Ser Gly Met  
 585 1590 1595 1600  
 Thr Ser Gly Leu Asp Ala Ala Ser Val Glu Arg Leu Ala Arg Thr Gly  
 1605 1610 1615  
 Ile Ala Glu Leu Ser Thr Glu Asp Gly Leu Arg Leu Phe Asp Ala Ala  
 1620 1625 1630  
 Phe Ala Lys Asp Arg Ala Cys Val Val Ala Ala Arg Leu Asp Arg Ala  
 1635 1640 1645  
 Leu Leu Val Gly Asn Gly Arg Ser His Ala Ile Pro Ala Leu Leu Ser  
 1650 1655 1660  
 Ala Leu Val Pro Val Arg Gly Gly Val Ala Arg Lys Thr Ala Asn Ser  
 665 1670 1675 1680  
 Gln Ala Ala Asp Glu Asp Ala Leu Leu Gly Leu Val Arg Glu His Val  
 1685 1690 1695  
 Ser Ala Val Leu Gly Tyr Ser Gly Ala Val Glu Val Gly Gly Asp Arg  
 1700 1705 1710  
 Ala Phe Arg Asp Leu Gly Phe Asp Ser Leu Ser Gly Val Glu Leu Arg  
 1715 1720 1725  
 Asn Arg Leu Ala Gly Val Leu Gly Val Arg Leu Pro Ala Thr Ala Val  
 1730 1735 1740  
 Phe Asp Tyr Pro Thr Pro Arg Ala Leu Ala Arg Phe Leu His Gln Glu  
 745 1750 1755 1760  
 Leu Ala Gly Glu Val Ala Ser Thr Ser Thr Pro Val Thr Arg Ala Ala  
 1765 1770 1775

Ser Ala Glu Glu Asp Leu Val Ala Ile Val Gly Met Gly Cys Arg Phe  
 1780 1785 1790

Pro Gly Gly Val Ser Ser Pro Glu Glu Leu Trp Arg Leu Val Ala Gly  
 1795 1800 1805

Gly Val Asp Ala Val Ala Gly Phe Pro Asp Asp Arg Gly Trp Asp Leu  
 1810 1815 1820

Ala Ala Leu Tyr Asp Pro Asp Pro Asp Arg Leu Gly Thr Ser Tyr Val  
 825 1830 1835 1840

Cys Glu Gly Gly Phe Leu Arg Asp Ala Ala Glu Phe Asp Ala Asp Met  
 1845 1850 1855

Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg  
 1860 1865 1870

Leu Leu Leu Glu Val Ala Trp Glu Thr Leu Glu Arg Ala Gly Ile Asp  
 1875 1880 1885

Pro Phe Ser Leu His Gly Ser Arg Thr Gly Val Phe Ala Gly Leu Met  
 1890 1895 1900

Tyr His Asp Tyr Gly Ala Arg Phe Ile Thr Arg Ala Pro Glu Gly Phe  
 905 1910 1915 1920

Glu Gly His Leu Gly Thr Gly Asn Ala Gly Ser Val Leu Ser Gly Arg  
 1925 1930 1935

Val Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr  
 1940 1945 1950

Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ala Leu  
 1955 1960 1965

Arg Ala Gly Glu Cys Glu Phe Ala Leu Ala Gly Gly Val Thr Val Met  
 1970 1975 1980

Ser Thr Pro Thr Thr Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala  
 985 1990 1995 2000

Pro Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala Ala Asp Gly Thr Gly  
 2005 2010 2015

Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala  
 2020 2025 2030

Arg Arg Asn Gly His Glu Val Leu Ala Val Val Arg Gly Ser Ala Val  
 2035 2040 2045

Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser  
 2050 2055 2060

Gln Gln Arg Val Ile Thr Gln Ala Leu Thr Ser Ala Gly Leu Ser Val  
 2065 2070 2075 2080

Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly  
 2085 2090 2095

Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Arg Asp Arg  
 2100 2105 2110

Asp Pro Gly Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly  
 2115 2120 2125

His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met  
 2130 2135 2140

Ala Met Arg Gln Gly Glu Leu Pro Arg Thr Leu His Val Asp Glu Pro  
 2145 2150 2155 2160

Ser Ala Gln Val Asp Trp Ser Ala Gly Thr Val Gln Leu Leu Thr Glu  
 2165 2170 2175

Asn Thr Pro Trp Pro Asp Ser Gly Arg Leu Arg Arg Ala Gly Val Ser  
 2180 2185 2190

Ser Phe Gly Ile Ser Gly Thr Asn Ala His Leu Ile Leu Glu Gln Pro  
 2195 2200 2205

Pro Arg Glu Ser Gln Arg Ser Thr Glu Pro Asp Ser Gly Ser Val Arg  
 2210 2215 2220

Asp Phe Pro Val Val Pro Trp Met Val Ser Gly Lys Thr Pro Glu Ala  
 2225 2230 2235 2240

Leu Ser Ala Gln Ala Asp Ala Leu Met Ser Tyr Leu Ser Asn Arg Val  
 2245 2250 2255

Asp Ala Ser Pro Arg Asp Ile Gly Tyr Ser Leu Ala Val Thr Arg Pro  
 2260 2265 2270

Ala Leu Asp His Arg Ala Val Val Leu Gly Ala Asp Arg Ala Ala Leu  
 2275 2280 2285



Leu Pro Gly Leu Lys Ala Leu Ala Val Ser Asn Asp Ala Ala Glu Val  
2290 2295 2300

Ile Thr Gly Thr Arg Ala Ala Gly Pro Val Gly Phe Val Phe Ser Gly  
305 2310 2315 2320

Gln Gly Gly Gln Trp Pro Gly Met Gly Ser Gly Leu His Ser Ala Phe  
2325 2330 2335

Pro Val Phe Ala Asp Ala Phe Asp Glu Ala Cys Cys Glu Leu Asp Ala  
2340 2345 2350

His Leu Gly Gln Met Ala Arg Leu Arg Asp Val Leu Ser Gly Ser Asp  
2355 2360 2365

Thr Gln Leu Leu Asp Gln Thr Leu Trp Ala Gln Pro Gly Leu Phe Ala  
2370 2375 2380

Leu Gln Val Gly Leu Trp Glu Leu Leu Gly Ser Trp Gly Val Arg Pro  
385 2390 2395 2400

Ala Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Ala Phe Ala  
2405 2410 2415

Ala Gly Val Leu Ser Leu Arg Asp Ala Ala Arg Leu Val Ala Gly Arg  
2420 2425 2430

Ala Arg Leu Met Gln Ala Leu Pro Thr Gly Gly Ala Met Leu Ala Ala  
2435 2440 2445

Ala Ala Gly Glu Glu Gln Leu Arg Pro Leu Leu Ala Asp Cys Gly Asp  
2450 2455 2460

Arg Val Gly Ile Ala Ala Val Asn Ala Pro Gly Ser Val Val Leu Ser  
465 2470 2475 2480

Gly Asp Arg Asp Val Leu Asp Asp Ile Ala Gly Arg Leu Asp Gly Gln  
2485 2490 2495

Gly Ile Arg Ser Arg Trp Leu Arg Val Ser His Ala Phe His Ser His  
2500 2505 2510

Arg Met Asp Pro Met Leu Ala Glu Phe Thr Glu Ile Ala Arg Ser Val  
2515 2520 2525

Asp Tyr Arg Ser Ser Gly Leu Pro Ile Val Ser Thr Leu Thr Gly Glu  
2530 2535 2540

Leu Asp Glu Val Gly Met Pro Ala Thr Pro Glu Tyr Trp Val Arg Gln  
 545 2550 2555 2560

Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Ala Ala Leu Ala Ala  
 2565 2570 2575

His Gly Val Ser Thr Val Val Glu Val Gly Pro Asp Gly Val Leu Ser  
 2580 2585 2590

Ala Leu Val Gln Glu Cys Ala Ala Gly Ser Asp Gln Gly Gly Arg Val  
 2595 2600 2605

Ala Ala Val Pro Leu Met Arg Ser Asn Arg Asp Glu Ala His Thr Val  
 2610 2615 2620

Thr Thr Ala Leu Ala Gln Ile His Val Arg Gly Ala Glu Val Asp Trp  
 625 2630 2635 2640

Arg Ser Phe Phe Ala Gly Thr Gly Ala Lys Gln Val Glu Leu Pro Thr  
 2645 2650 2655

Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Asp Ser Pro Ser Glu Pro  
 2660 2665 2670

Val Gly Gln Ser Ala Asp Pro Ala Arg Gln Ser Gly Phe Trp Glu Leu  
 2675 2680 2685

Val Glu Gln Glu Asp Val Ser Ala Leu Ser Ala Ala Leu His Ile Thr  
 2690 2695 2700

Gly Asp His Asp Val Gln Ala Ser Leu Glu Ser Val Val Pro Val Leu  
 705 2710 2715 2720

Ser Ser Trp His Arg Arg Ile Arg Asn Glu Ser Leu Val His Gln Trp  
 2725 2730 2735

Arg Tyr Arg Ile Ser Trp His Glu Arg Ala Asp Leu Pro Asp Pro Ser  
 2740 2745 2750

Leu Ser Gly Thr Trp Leu Val Val Val Pro Glu Gly Trp Ser Ala Ser  
 2755 2760 2765

Arg Gln Val Leu Arg Phe Asn Glu Met Phe Glu Glu Arg Gly Cys Pro  
 2770 2775 2780

Ala Val Leu Phe Glu Leu Ala Gly His Asp Glu Glu Ala Leu Ala Gln  
 785 2790 2795 2800

Arg Phe Arg Ser Leu Pro Val Ala Ser Gly Gly Ile Ser Gly Val Leu  
 2805 2810 2815

Ser Leu Leu Ala Leu Asp Glu Ser Pro Ser Ser Pro Asn Ala Ala Leu  
 2820 2825 2830

Pro Asn Gly Ala Leu Asn Ser Leu Val Leu Leu Arg Ala Leu Arg Ala  
 2835 2840 2845

Ala Asp Val Ser Ala Pro Leu Trp Leu Ala Thr Cys Gly Gly Val Ala  
 2850 2855 2860

Val Gly Asp Val Pro Val Asn Pro Gly Gln Ala Leu Val Trp Gly Leu  
 865 2870 2875 2880

Gly Arg Val Val Gly Leu Glu His Pro Ala Trp Trp Gly Gly Leu Val  
 2885 2890 2895

Asp Val Pro Cys Leu Leu Asp Glu Asp Ala Arg Glu Arg Leu Ser Val  
 2900 2905 2910

Val Leu Ala Gly Leu Gly Glu Asp Glu Ile Ala Val Arg Pro Gly Gly  
 2915 2920 2925

Val Phe Val Arg Arg Leu Glu Arg Ala Gly Ala Ala Ser Gly Ala Gly  
 2930 2935 2940

Ser Val Trp Arg Pro Arg Gly Thr Val Leu Val Thr Gly Gly Thr Gly  
 945 2950 2955 2960

Gly Leu Gly Ala His Val Ala Arg Trp Leu Ala Gly Ala Gly Ala Glu  
 2965 2970 2975

His Val Val Leu Thr Ser Arg Arg Gly Ala Ala Ala Pro Gly Ala Gly  
 2980 2985 2990

Asp Leu Arg Ala Glu Leu Glu Ala Leu Gly Ala Arg Val Ser Ile Thr  
 2995 3000 3005

Ala Cys Asp Val Ala Asp Arg Asp Ala Leu Ala Glu Val Leu Ala Thr  
 3010 3015 3020

Ile Pro Asp Asp Cys Pro Leu Thr Ala Val Met His Ala Ala Gly Val  
 025 3030 3035 3040

Val Glu Val Gly Asp Val Ala Ser Met Cys Leu Thr Asp Phe Val Gly  
 3045 3050 3055

Val Leu Ser Ala Lys Ala Gly Gly Ala Ala Asn Leu Asp Glu Leu Leu  
 3060 3065 3070

Ala Asp Val Glu Leu Asp Ala Phe Val Leu Phe Ser Ser Val Ser Gly  
 3075 3080 3085

Val Trp Gly Ala Gly Gly Gln Gly Ala Tyr Ala Ala Ala Asn Ala Tyr  
 3090 3095 3100

Leu Asp Ala Leu Ala Gln Gln Arg Arg Ala Arg Gly Leu Val Gly Thr  
 105 3110 3115 3120

Ala Val Ala Trp Gly Pro Trp Ala Gly Asp Gly Met Ala Ala Gly Glu  
 3125 3130 3135

Gly Gly Ala Gln Leu Arg Arg Ala Gly Leu Val Pro Met Ala Ala Asp  
 3140 3145 3150

Arg Ala Leu Leu Ala Leu Gln Gly Ala Leu Asp Arg Asp Glu Thr Ser  
 3155 3160 3165

Leu Val Val Ala Asp Met Ala Trp Glu Arg Phe Ala Pro Val Phe Ala  
 3170 3175 3180

Met Ser Arg Arg Arg Pro Leu Leu Asp Glu Leu Pro Glu Ala Gln Gln  
 185 3190 3195 3200

Ala Leu Ala Asp Ala Glu Asn Thr Thr Asp Ala Ala Asp Ser Ala Val  
 3205 3210 3215

Pro Leu Pro Arg Leu Ala Gly Met Ala Ala Ala Glu Arg Arg Arg Ala  
 3220 3225 3230

Met Leu Asp Leu Val Leu Ala Glu Ala Ser Ile Val Leu Gly His Asn  
 3235 3240 3245

Gly Ser Asp Pro Val Gly Pro Asp Arg Ala Phe Gln Glu Leu Gly Phe  
 3250 3255 3260

Asp Ser Leu Met Ala Val Glu Leu Arg Asn Arg Leu Gly Glu Ala Thr  
 265 3270 3275 3280

Gly Leu Ser Leu Pro Ala Thr Leu Ile Phe Asp Tyr Pro Ser Pro Ser  
 3285 3290 3295

Ala Leu Ala Glu Gln Leu Val Gly Glu Leu Val Gly Ala Gln Pro Ala  
 3300 3305 3310

Thr Thr Val Val Ala Gly Ala Asp Pro Val Asp Asp Pro Val Val Val  
 3315 3320 3325

Val Ala Met Gly Cys Arg Tyr Pro Gly Asp Val Cys Ser Pro Glu Glu  
 3330 3335 3340

Leu Trp Gln Leu Val Ser Ala Gly Arg Asp Ala Val Ser Thr Phe Pro  
 345 3350 3355 3360

Val Asp Arg Gly Trp Asp Cys Asn Thr Leu Phe Asp Pro Asp Pro Asp  
 3365 3370 3375

Arg Ala Gly Ser Thr Tyr Val Arg Glu Gly Ala Phe Leu Thr Gly Ala  
 3380 3385 3390

Asp Arg Phe Asp Ala Gly Phe Phe Gly Ile Ser Pro Arg Glu Ala Arg  
 3395 3400 3405

Ala Met Asp Pro Gln Gln Arg Leu Leu Leu Glu Val Ala Trp Glu Val  
 3410 3415 3420

Phe Glu Arg Ala Gly Ile Ala Pro Leu Ser Leu Arg Gly Ser Arg Thr  
 425 3430 3435 3440

Gly Val Phe Ala Gly Thr Asn Gly Gln Asp His Gly Ala Lys Val Ala  
 3445 3450 3455

Ala Ala Pro Glu Ala Ala Gly His Leu Leu Thr Gly Asn Ala Ala Ser  
 3460 3465 3470

Val Leu Ala Gly Arg Leu Ser Tyr Thr Phe Gly Leu Glu Gly Pro Ala  
 3475 3480 3485

Val Ala Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu  
 3490 3495 3500

Ala Cys Gln Ser Leu Arg Ser Gly Glu Cys Asp Met Ala Leu Ala Gly  
 505 3510 3515 3520

Gly Val Thr Val Met Ser Thr Pro Leu Ala Phe Leu Glu Phe Ser Arg  
 3525 3530 3535

Gln Arg Gly Leu Ala Pro Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala  
 3540 3545 3550

Ala Asp Gly Thr Gly Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu  
 3555 3560 3565

Arg Leu Ser Asp Ala Arg Arg Asn Gly His Arg Val Leu Ala Val Val  
 3570 3575 3580

Arg Gly Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala  
 585 3590 3595 3600

Pro Asn Gly Pro Ser Gln Gln Arg Val Ile Arg Gln Ala Leu Ala Asn  
 3605 3610 3615

Ala Gly Leu Ser Ala Ser Asp Val Asp Val Val Glu Ala His Gly Thr  
 3620 3625 3630

Gly Thr Gly Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr  
 3635 3640 3645

Tyr Gly Gln Glu Arg Asp Pro Glu Arg Ala Leu Trp Leu Gly Ser Ile  
 3650 3655 3660

Lys Ser Asn Ile Gly His Thr Gln Ala Ala Ala Gly Val Ala Gly Val  
 665 3670 3675 3680

Ile Lys Met Val Gln Ala Met Arg His Gly Glu Leu Pro Ala Thr Leu  
 3685 3690 3695

His Val Asp Lys Pro Thr Pro Gln Val Asp Trp Ser Ala Gly Ala Val  
 3700 3705 3710

Arg Leu Leu Thr Gly Asn Thr Pro Trp Pro Glu Ser Gly Arg Pro Arg  
 3715 3720 3725

Arg Ala Gly Val Ser Ser Phe Gly Ile Ser Gly Thr Asn Ala His Leu  
 3730 3735 3740

Ile Leu Glu Gln Pro Pro Ser Glu Pro Ala Glu Ile Asp Gln Ser Asp  
 745 3750 3755 3760

Arg Arg Val Thr Ala His Pro Ala Val Ile Pro Trp Met Leu Ser Ala  
 3765 3770 3775

Arg Ser Leu Ala Ala Leu Gln Ala Gln Ala Ala Ala Leu Gln Ala Arg  
 3780 3785 3790

Leu Asp Arg Gly Pro Gly Ala Ser Pro Leu Asp Leu Gly Tyr Ser Leu  
 3795 3800 3805

Ala Thr Thr Arg Ser Val Leu Asp Glu Arg Ala Val Val Trp Gly Ala  
 3810 3815 3820

Asp Arg Glu Ala Leu Leu Ser Arg Leu Ala Ala Leu Ala Asp Gly Arg  
 825 3830 3835 3840

Thr Ala Pro Gly Val Ile Thr Gly Ser Ala Asn Ser Gly Gly Arg Ile  
 3845 3850 3855

Gly Phe Val Phe Ser Gly Gln Gly Ser Gln Trp Leu Gly Met Gly Lys  
 3860 3865 3870

Ala Leu Cys Ala Ala Phe Pro Ala Phe Ala Asp Ala Phe Glu Glu Ala  
 3875 3880 3885

Cys Asp Ala Leu Ser Ala His Leu Gly Ala Asp Val Arg Gly Val Leu  
 3890 3895 3900

Phe Gly Ala Asp Glu Gln Met Leu Asp Arg Thr Leu Trp Ala Gln Ser  
 905 3910 3915 3920

Gly Ile Phe Ala Val Gln Val Gly Leu Leu Gly Leu Leu Arg Ser Trp  
 3925 3930 3935

Gly Val Arg Pro Ala Ala Val Leu Gly His Ser Val Gly Glu Leu Ala  
 3940 3945 3950

Ala Ala His Ala Ala Gly Val Leu Ser Leu Pro Asp Ala Ala Arg Leu  
 3955 3960 3965

Val Ala Ala Arg Ala His Leu Met Gln Ala Leu Pro Thr Gly Gly Ala  
 3970 3975 3980

Met Leu Ala Val Ala Thr Ser Glu Ala Ala Val Gly Pro Leu Leu Ser  
 985 3990 3995 4000

Gly Val Cys Asp Arg Val Ser Ile Ala Ala Ile Asn Gly Pro Glu Ser  
 4005 4010 4015

Val Val Leu Ser Gly Asp Arg Asp Val Leu Val Glu Leu Ala Gly Glu  
 4020 4025 4030

Phe Asp Ala Arg Gly Leu Arg Thr Lys Trp Leu Arg Val Ser His Ala  
 4035 4040 4045

Phe His Ser His Arg Met Glu Pro Ile Leu Asp Glu Tyr Ala Glu Thr  
 4050 4055 4060

Ala Arg Cys Val Glu Phe Gly Glu Pro Val Val Pro Ile Val Ser Ala  
 065 4070 4075 4080

Ala Thr Gly Ala Leu Asp Thr Thr Gly Leu Met Cys Ala Ala Asp Tyr  
 4085 4090 4095

Trp Thr Arg Gln Val Arg Asp Pro Val Arg Phe Gly Asp Gly Val Arg  
 4100 4105 4110

Ala Leu Val Gly Gln Gly Val Asp Thr Ile Val Glu Phe Gly Pro Asp  
 4115 4120 4125

Gly Ala Leu Ser Ala Leu Val Glu Gln Cys Leu Ala Gly Ser Asp Gln  
 4130 4135 4140

Ala Gly Arg Val Ala Ala Ile Pro Leu Met Arg Arg Asp Arg Asp Glu  
 145 4150 4155 4160

Val Glu Thr Ala Val Ala Ala Leu Ala His Val His Val Arg Gly Gly  
 4165 4170 4175

Ala Val Asp Trp Ser Ala Cys Phe Ala Gly Thr Gly Ala Arg Thr Val  
 4180 4185 4190

Glu Leu Pro Thr Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Ala Gly  
 4195 4200 4205

Gln Ala Asp Gly Arg Gly Gly Asp Val Val Ala Asp Pro Val Asp Ala  
 4210 4215 4220

Arg Phe Trp Glu Leu Val Glu Arg Ala Asp Pro Glu Pro Leu Val Asp  
 225 4230 4235 4240

Glu Leu Cys Ile Asp Arg Asp Gln Pro Phe Arg Glu Val Leu Pro Val  
 4245 4250 4255

Leu Ala Ser Trp Arg Glu Lys Gln Arg Gln Glu Ala Leu Ala Asp Ser  
 4260 4265 4270

Trp Arg Tyr Gln Val Arg Trp Arg Ser Val Glu Val Pro Ser Ala Ala  
 4275 4280 4285

Ala Leu Arg Gly Val Trp Leu Val Val Leu Pro Ala Asp Val Pro Arg  
 4290 4295 4300

Asp Gln Pro Ala Val Val Ile Asp Ala Leu Ile Ala Arg Gly Ala Glu  
 305 4310 4315 4320

Val Ala Val Leu Glu Leu Thr Glu Gln Asp Leu Gln Arg Ser Ala Leu  
 4325 4330 4335



Val Asp Lys Val Arg Ala Val Ile Ala Asp Arg Thr Glu Val Thr Gly  
 4340 4345 4350  
 Val Leu Ser Leu Leu Ala Met Asp Gly Met Pro Cys Ala Ala His Pro  
 4355 4360 4365  
 His Leu Ser Arg Gly Val Ala Ala Thr Val Ile Leu Thr Gln Val Leu  
 4370 4375 4380  
 Gly Asp Ala Gly Val Ser Ala Pro Leu Trp Leu Ala Thr Thr Gly Gly  
 385 4390 4395 4400  
 Val Glu Ala Gly Thr Glu Asp Gly Pro Ala Asp Pro Asp His Gly Leu  
 4405 4410 4415  
 Ile Trp Gly Leu Gly Arg Val Val Gly Leu Glu His Pro Gln Trp Trp  
 4420 4425 4430  
 Gly Gly Leu Ile Asp Leu Pro Glu Thr Leu Asp Glu Thr Ser Arg Asn  
 4435 4440 4445  
 Gly Leu Val Ala Ala Leu Ala Gly Thr Ala Ala Glu Asp Gln Leu Ala  
 4450 4455 4460  
 Val Arg Ser Ser Gly Leu Phe Val Arg Arg Val Val Arg Ala Ala Arg  
 4465 4470 4475 4480  
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 His Asp Pro Ile Ala Ile Val Ser Met Gly Cys Arg Tyr Pro Gly Gly  
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Cys Asp Leu Ala Leu Ala Gly Gly Ile Ser Val Met Ala Thr Pro Gly	
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Cys Lys Pro Phe Ala Asp Ala Ala Asp Gly Thr Gly Trp Gly Glu Gly	
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Gln Ile Ala Val Gly Gly Pro Asp Glu Ala Gly Arg Arg Ser Val Arg	
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Val His Ser Cys Arg Asp Asp Ala Val Pro Gln Asp Ser Trp Thr Cys	
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Lys Gln Leu Ala Ala Ala Arg Ala Met Glu His Glu Ser Leu Phe Arg	
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Pro Glu His Val Ala Lys Val Phe Gly Pro Lys Ala Ala Gly Ala Trp	
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His Leu His Glu Leu Thr Leu Asp Leu Asp Leu Ser Phe Phe Val Leu	
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 Met His His Asp Tyr Gly Ala Arg Phe Ile Thr Arg Ala Pro Glu Gly  
 1905 1910 1915 1920

ttc gag ggt tat cta ggt aat ggc agc gcg gga ggc gtg ttt tcg ggt 5808  
 Phe Glu Gly Tyr Leu Gly Asn Gly Ser Ala Gly Gly Val Phe Ser Gly  
 1925 1930 1935

cgg gtt gcg tat tcg ttt ggt ttc gag ggt cct gcg gtg acg gtg gat 5856  
 Arg Val Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp  
 1940 1945 1950

acg gcg tgt tcg tcg tcg ttg gtg gcg ctg cac ctg gcg ggt caa gca 5904  
 Thr Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ala  
 1955 1960 1965

ctg cgg tct ggt gag tgt gat ctg gct ctt gcg ggt ggt gtg acg gtg 5952  
 Leu Arg Ser Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val  
 1970 1975 1980

atg gcc acg ccg ggg atg ttc gtg gag ttt tcg cgt caa cgg ggc ttg 6000  
 Met Ala Thr Pro Gly Met Phe Val Glu Phe Ser Arg Gln Arg Gly Leu  
 1985 1990 1995 2000

gcg gcg gat ggg cgg tgc aag tcg ttt gcg gcg gct gcg gat ggc acc	6048
Ala Ala Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala Ala Asp Gly Thr	
2005 2010 2015	
ggt tgg gga gaa ggc gcg ggc ttg gtg ttg ttg gag cgg ctg tcg gat	6096
Gly Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp	
2020 2025 2030	
gcc cgg cgc aac ggg cac gcg gtt ctg gcg gtc gtg cgg ggt agc gcg	6144
Ala Arg Arg Asn Gly His Ala Val Leu Ala Val Val Arg Gly Ser Ala	
2035 2040 2045	
gtg aat cag gat ggt gcg tcg aat ggt ttg acg gcg ccg aat ggg ccc	6192
Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro	
2050 2055 2060	
tcg cag cag cgg gtg atc acg cag gcg ttg gcg agt gct ggt ttg tcg	6240
Ser Gln Gln Arg Val Ile Thr Gln Ala Leu Ala Ser Ala Gly Leu Ser	
2065 2070 2075 2080	
gtg tct gat gtg gac gcc gtg gag gcg cat ggg act gga acc agg ctt	6288
Val Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu	
2085 2090 2095	
ggt gat ccg att gag gcg cag gct ctg att gcc act tac ggg cag ggg	6336
Gly Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Gln Gly	
2100 2105 2110	
cgg gat agc gat cgg ccg ttg tgg ttg ggg tcg gtg aag tcg aat att	6384
Arg Asp Ser Asp Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile	
2115 2120 2125	
ggt cat acg cag gcg gcg gcg ggt gtc gct ggt gtg atc aag atg gtg	6432
Gly His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val	
2130 2135 2140	
atg gcg atg cgg cac ggg cag ctg ccc gcg acg ttg cat gtg gat gaa	6480
Met Ala Met Arg His Gly Gln Leu Pro Ala Thr Leu His Val Asp Glu	
2145 2150 2155 2160	
cct acg tcg gaa gtg gat tgg tcg gcg ggg gat gtc cag ctc ctc acg	6528
Pro Thr Ser Glu Val Asp Trp Ser Ala Gly Asp Val Gln Leu Leu Thr	
2165 2170 2175	
gag aac acc ccc tgg ccc ggc aac agc cat cct cgg cgg gtg ggc gtg	6576
Glu Asn Thr Pro Trp Pro Gly Asn Ser His Pro Arg Arg Val Gly Val	
2180 2185 2190	

tcg tcg ttc ggg atc agc ggc acc aac gca cac gtc atc ctc gaa caa	6624
Ser Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln	
2195 2200 2205	
gcc tcg aaa aca cca gac gag act gcg gac aag agc ggt ccc gat tcg	6672
Ala Ser Lys Thr Pro Asp Glu Thr Ala Asp Lys Ser Gly Pro Asp Ser	
2210 2215 2220	
gaa tcg acc gtg gac ctt cca gcg gtc ccg ttg atc gtg tcg ggg aga	6720
Glu Ser Thr Val Asp Leu Pro Ala Val Pro Leu Ile Val Ser Gly Arg	
2225 2230 2235 2240	
aca ccg gca gcg ctc agc gct cag gcg agc gca ttg ttg tcc tat ttg	6768
Thr Pro Ala Ala Leu Ser Ala Gln Ala Ser Ala Leu Leu Ser Tyr Leu	
2245 2250 2255	
ggg gag cgt ggc gat att tcc acg ctg gat gcg gcg ttt tcg ttg gct	6816
Gly Glu Arg Gly Asp Ile Ser Thr Leu Asp Ala Ala Phe Ser Leu Ala	
2260 2265 2270	
tcc tcc cgg gcc gcg ttg gag gag cgg gcg gtg gtg ctg gga gcg gac	6864
Ser Ser Arg Ala Ala Leu Glu Glu Arg Ala Val Val Leu Gly Ala Asp	
2275 2280 2285	
cgc gaa acg ttg ttg tcc ggg ttg gaa gcg ctg gct tcc ggt cgc gag	6912
Arg Glu Thr Leu Leu Ser Gly Leu Glu Ala Leu Ala Ser Gly Arg Glu	
2290 2295 2300	
gct tct ggg gtg gtg tcg gga tcc ccg gtc tct ggc ggg gtt ggg ttc	6960
Ala Ser Gly Val Val Ser Gly Ser Pro Val Ser Gly Gly Val Gly Phe	
2305 2310 2315 2320	
gtg ttc gcc ggt cag ggc gga cag tgg ttg ggg atg ggc cgg ggg ctc	7008
Val Phe Ala Gly Gln Gly Gly Gln Trp Leu Gly Met Gly Arg Gly Leu	
2325 2330 2335	
tac tcg gtt ttt ccg gtg ttc gct gac gcg ttt gac gaa gca tgt gcc	7056
Tyr Ser Val Phe Pro Val Phe Ala Asp Ala Phe Asp Glu Ala Cys Ala	
2340 2345 2350	
gga ctg gac gcg cat ctg ggg cag gac gtg ggg gtc cgg gat gtg gtg	7104
Gly Leu Asp Ala His Leu Gly Gln Asp Val Gly Val Arg Asp Val Val	
2355 2360 2365	
ttt ggt tcc gac ggg tcc ttg ttg gat cgg acg ctg tgg gcc cag tcg	7152
Phe Gly Ser Asp Gly Ser Leu Leu Asp Arg Thr Leu Trp Ala Gln Ser	
2370 2375 2380	

ggt ttg ttc gcg ttg cag gtt ggt ttg ctg agc ctg ctg ggt tgc tgg	7200
Gly Leu Phe Ala Leu Gln Val Gly Leu Leu Ser Leu Leu Gly Ser Trp	
2385                      2390                      2395                      2400	
ggt gtc cgg ccg ggt gtg gtg ctg ggc cat tgc gtc ggc gag ttc gcg	7248
Gly Val Arg Pro Gly Val Val Leu Gly His Ser Val Gly Glu Phe Ala	
2405                      2410                      2415	
gcg gcg gtt gcg gcg gga gtg ttg tgc ttg ccg gat gcg gct cgg atg	7296
Ala Ala Val Ala Ala Gly Val Leu Ser Leu Pro Asp Ala Ala Arg Met	
2420                      2425                      2430	
gtg gcg ggt cgt gcc cgg ttg atg cag gcg ttg cct tct ggc ggt gcc	7344
Val Ala Gly Arg Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Ala	
2435                      2440                      2445	
atg ttg gcg gtg gct gct ggt gag gag cag ctg cgg ccg ttg ttg gcc	7392
Met Leu Ala Val Ala Ala Gly Glu Glu Gln Leu Arg Pro Leu Leu Ala	
2450                      2455                      2460	
gat cgg gtt gat ggt gcg ggt atc gcc gcg gtc aac gct cct gag tgc	7440
Asp Arg Val Asp Gly Ala Gly Ile Ala Ala Val Asn Ala Pro Glu Ser	
2465                      2470                      2475                      2480	
gtg gtg ctc tcc ggc gat cgg gag gtg ctt gac gac atc gcc ggc gcg	7488
Val Val Leu Ser Gly Asp Arg Glu Val Leu Asp Asp Ile Ala Gly Ala	
2485                      2490                      2495	
ctg gat ggg caa ggg att cgg tgg cgg cgg ttg cgg gtt tgc cat gcg	7536
Leu Asp Gly Gln Gly Ile Arg Trp Arg Arg Leu Arg Val Ser His Ala	
2500                      2505                      2510	
ttt cat tgc tat cgg atg gac ccg atg ttg cag gag ttc gcc gaa atc	7584
Phe His Ser Tyr Arg Met Asp Pro Met Leu Gln Glu Phe Ala Glu Ile	
2515                      2520                      2525	
gca cgc agc gtg gac tac cgg cgt ggc gac cta ccg gtc gtg tgc acg	7632
Ala Arg Ser Val Asp Tyr Arg Arg Gly Asp Leu Pro Val Val Ser Thr	
2530                      2535                      2540	
ttg acg ggt gag ctc gac acc gca ggt gtg atg gct acg ccg gag tat	7680
Leu Thr Gly Glu Leu Asp Thr Ala Gly Val Met Ala Thr Pro Glu Tyr	
2545                      2550                      2555                      2560	
tgg gtg cgt cag gtt cga gag ccc gtc cgc ttc gcc gac ggc gtc cgg	7728
Trp Val Arg Gln Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Arg	
2565                      2570                      2575	



gtg ctc gcg cag caa ggg gtc gcc acg atc ttc gaa ctc ggc cct gat	7776
Val Leu Ala Gln Gln Gly Val Ala Thr Ile Phe Glu Leu Gly Pro Asp	
2580 2585 2590	
gcg acg ctg tcg gcc ctg att ccc gat tgt cat tcg tgg gct gat cag	7824
Ala Thr Leu Ser Ala Leu Ile Pro Asp Cys His Ser Trp Ala Asp Gln	
2595 2600 2605	
gcc atg ccg att ccg atg ctg cgt aaa gac cgt acg gaa acc gaa act	7872
Ala Met Pro Ile Pro Met Leu Arg Lys Asp Arg Thr Glu Thr Glu Thr	
2610 2615 2620	
gtg gtc gcc gcg gtg gcg cgg gcg cac acg cgt ggt gtt ccg gtc gaa	7920
Val Val Ala Ala Val Ala Arg Ala His Thr Arg Gly Val Pro Val Glu	
2625 2630 2635 2640	
tgg tcg gcg tat ttc gcc ggc acc ggg gca cgg cgg gtc gag ttg ccg	7968
Trp Ser Ala Tyr Phe Ala Gly Thr Gly Ala Arg Arg Val Glu Leu Pro	
2645 2650 2655	
acg tat gcc ttc cag cgg cag cgg tac tgg ctg gaa aca tcg gat tac	8016
Thr Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Glu Thr Ser Asp Tyr	
2660 2665 2670	
ggc gat gtg acg ggt atc ggc ctg gct gcg gcg gag cat ccg ttg ctg	8064
Gly Asp Val Thr Gly Ile Gly Leu Ala Ala Ala Glu His Pro Leu Leu	
2675 2680 2685	
ggg gcc gtg gtt gcg ctg gcc gat ggt gat ggg atg gtg ctg acc ggc	8112
Gly Ala Val Val Ala Leu Ala Asp Gly Asp Gly Met Val Leu Thr Gly	
2690 2695 2700	
cgg ttg tcg gtg ggg acg cat ccg tgg ctg gcc cag cat cgc gtg ctg	8160
Arg Leu Ser Val Gly Thr His Pro Trp Leu Ala Gln His Arg Val Leu	
2705 2710 2715 2720	
ggc gag gtc gtc gtc ccc ggc acc gcc atc ctg gag atg gcc ctg cac	8208
Gly Glu Val Val Val Pro Gly Thr Ala Ile Leu Glu Met Ala Leu His	
2725 2730 2735	
gca ggg gcg cgt ctc ggc tgt gac cgg gtg gaa gag ctc acc ctg gaa	8256
Ala Gly Ala Arg Leu Gly Cys Asp Arg Val Glu Glu Leu Thr Leu Glu	
2740 2745 2750	
aca ccg ctg gtg gtc ccc gaa cgc gcg gcg ggt gcc ggt agt cgt ggc	8304
Thr Pro Leu Val Val Pro Glu Arg Ala Ala Gly Ala Gly Ser Arg Gly	
2755 2760 2765	

cct gcg gga ggg acc aca gtt tca att gaa act gcg gaa gaa cgt gtg	8352
Pro Ala Gly Gly Thr Thr Val Ser Ile Glu Thr Ala Glu Glu Arg Val	
2770 2775 2780	
cgg acg aac gac gcc atc gaa atc cag ctg ctg gtg aac gca ccc gac	8400
Arg Thr Asn Asp Ala Ile Glu Ile Gln Leu Leu Val Asn Ala Pro Asp	
2785 2790 2795 2800	
gaa ggc ggt cgg cga agg gtg tcg ctg tat tcc cgc ccg gcc ggt ggg	8448
Glu Gly Gly Arg Arg Arg Val Ser Leu Tyr Ser Arg Pro Ala Gly Gly	
2805 2810 2815	
tcg aga ggt ggg ggt tgg acg cgc cac gcc acc ggc gaa ctc gtc gtc	8496
Ser Arg Gly Gly Gly Trp Thr Arg His Ala Thr Gly Glu Leu Val Val	
2820 2825 2830	
ggc acc acc ggt ggt agg gcg gtt cct gat tgg tcg gct gag ggt gcc	8544
Gly Thr Thr Gly Gly Arg Ala Val Pro Asp Trp Ser Ala Glu Gly Ala	
2835 2840 2845	
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Glu Ser Ile Ala Leu Asp Glu Phe Tyr Val Ala Leu Ala Gly Asn Gly	
2850 2855 2860	
ttc gag tac ggg ccg ttg ttc cag ggg ctt cag gcg gca tgg cgt cgt	8640
Phe Glu Tyr Gly Pro Leu Phe Gln Gly Leu Gln Ala Ala Trp Arg Arg	
2865 2870 2875 2880	
ggt gac gag gtt ctc gcc gaa atc gcc ccg ccg gcc gag gcc gat gcg	8688
Gly Asp Glu Val Leu Ala Glu Ile Ala Pro Pro Ala Glu Ala Asp Ala	
2885 2890 2895	
atg gcg tcg gga tac ctg ctc gac cca gcg ttg ctg gat gcc gcg ctg	8736
Met Ala Ser Gly Tyr Leu Leu Asp Pro Ala Leu Leu Asp Ala Ala Leu	
2900 2905 2910	
cag gcg tcc gcg ctc ggc gac cgc ccg gag caa ggc ggc gcg tgg ctg	8784
Gln Ala Ser Ala Leu Gly Asp Arg Pro Glu Gln Gly Gly Ala Trp Leu	
2915 2920 2925	
ccg ttc tca ttc acc ggc gtc gaa ctt tcc gct ccg gca ggg acg atc	8832
Pro Phe Ser Phe Thr Gly Val Glu Leu Ser Ala Pro Ala Gly Thr Ile	
2930 2935 2940	
agc agg gtg cgg ctg gag acc agg cga ccc gac gcg ata tcg gtg gcc	8880
Ser Arg Val Arg Leu Glu Thr Arg Arg Pro Asp Ala Ile Ser Val Ala	
2945 2950 2955 2960	

gtg atg gat gag agt ggg cgg ttg ctc gcc tcg atc gat tct ctc agg 8928  
 Val Met Asp Glu Ser Gly Arg Leu Leu Ala Ser Ile Asp Ser Leu Arg  
 2965 2970 2975

cta cga agc gtg tcg tcg gga cag ctg gcg aat cgg gac gct gtc cgc 8976  
 Leu Arg Ser Val Ser Ser Gly Gln Leu Ala Asn Arg Asp Ala Val Arg  
 2980 2985 2990

gac gcg ctg ttc gag gtg acc tgg gag ccg gtg gcg acg cag tcg acg 9024  
 Asp Ala Leu Phe Glu Val Thr Trp Glu Pro Val Ala Thr Gln Ser Thr  
 2995 3000 3005

gaa ccg ggt cgc tgg gcc ctg ctt ggt gat act gcc tgc ggt aaa gac 9072  
 Glu Pro Gly Arg Trp Ala Leu Leu Gly Asp Thr Ala Cys Gly Lys Asp  
 3010 3015 3020

gat ctc atc aaa ctc gca acg gat tcc gcc gac cgc tgc gcg gat ctg 9120  
 Asp Leu Ile Lys Leu Ala Thr Asp Ser Ala Asp Arg Cys Ala Asp Leu  
 3025 3030 3035 3040

gcg gcg cta gcc gag aaa ctt gat tcc agc gcg ctg gtt cct gat gtc 9168  
 Ala Ala Leu Ala Glu Lys Leu Asp Ser Ser Ala Leu Val Pro Asp Val  
 3045 3050 3055

gtg gtc tac tgc gcc gga gaa cag gcg gat ccc ggc acc ggc gca gcc 9216  
 Val Val Tyr Cys Ala Gly Glu Gln Ala Asp Pro Gly Thr Gly Ala Ala  
 3060 3065 3070

gca ctt gcg gag acc cag cag acg ttg gct ctg ctc caa gcg tgg ttg 9264  
 Ala Leu Ala Glu Thr Gln Gln Thr Leu Ala Leu Leu Gln Ala Trp Leu  
 3075 3080 3085

gct gag ccg cgg ttg gcc gag gca cgt ctg gtg gtg gtg acg tgt gca 9312  
 Ala Glu Pro Arg Leu Ala Glu Ala Arg Leu Val Val Val Thr Cys Ala  
 3090 3095 3100

gcg gtg acg acg gct ccg agt gac ggt gca tca gag ctg gca cat gcg 9360  
 Ala Val Thr Thr Ala Pro Ser Asp Gly Ala Ser Glu Leu Ala His Ala  
 3105 3110 3115 3120

ccg ttg tgg ggg ttg ttg cgt gcc gcg cag gtg gag aac ccg ggg cag 9408  
 Pro Leu Trp Gly Leu Leu Arg Ala Ala Gln Val Glu Asn Pro Gly Gln  
 3125 3130 3135

ttt gtg ctg gcg gac gtc gac gga acc gcc gaa tcg tgg cgt gcg ttg 9456  
 Phe Val Leu Ala Asp Val Asp Gly Thr Ala Glu Ser Trp Arg Ala Leu  
 3140 3145 3150

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Pro Ser Ala Leu Gly Ser Met Glu Pro Gln Leu Ala Leu Arg Lys Gly	
3155 3160 3165	
gcg gtg cga gcg ccc cgc ttg gct tcg gtc gcc ggg cag atc gac gtg	9552
Ala Val Arg Ala Pro Arg Leu Ala Ser Val Ala Gly Gln Ile Asp Val	
3170 3175 3180	
ccc gcg gtt gtg gcg gat ccc gac cga acc gtg ctg att tcg ggc ggc	9600
Pro Ala Val Val Ala Asp Pro Asp Arg Thr Val Leu Ile Ser Gly Gly	
3185 3190 3195 3200	
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Thr Gly Leu Leu Gly Gly Ala Val Ala Arg His Leu Val Thr Glu Arg	
3205 3210 3215	
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Gly Val Arg Arg Leu Val Leu Thr Gly Arg Arg Gly Trp Asp Ala Pro	
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3235 3240 3245	
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Asp Val Val Ala Cys Asp Val Ala Asp Arg Ala Asp Leu Glu Ser Leu	
3250 3255 3260	
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Leu Ala Ala Val Pro Ala Glu Phe Pro Leu Cys Gly Val Val His Ala	
3265 3270 3275 3280	
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Ala Gly Ala Leu Ala Asp Gly Val Ile Glu Ser Leu Ser Pro Asp Asp	
3285 3290 3295	
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Val Gly Ala Val Phe Gly Pro Lys Ala Ala Gly Ala Trp Asn Leu His	
3300 3305 3310	
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Glu Leu Thr Arg Asp Thr Asp Leu Ser Phe Phe Ala Leu Phe Ser Ser	
3315 3320 3325	
ctt tcc ggt gtt gcc ggc gct cct ggt cag ggc aat tat gcg gcg gcg	10032
Leu Ser Gly Val Ala Gly Ala Pro Gly Gln Gly Asn Tyr Ala Ala Ala	
3330 3335 3340	

289

gac gag atc gct acg acg cca gcg ccg gtg acg acg acc agg gca ccg	10656
Asp Glu Ile Ala Thr Thr Pro Ala Pro Val Thr Thr Thr Arg Ala Pro	
3540 3545 3550	
gtc gcc gaa gac gat ctc gtc gcg ata gtc ggg atg gga tgc cgt ttt	10704
Val Ala Glu Asp Asp Leu Val Ala Ile Val Gly Met Gly Cys Arg Phe	
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Pro Gly Gln Val Ser Ser Pro Glu Glu Leu Trp Arg Leu Val Ala Gly	
3570 3575 3580	
ggc gtg gat gcg gtc gcg gac ttc cca gcc gat cgc ggc tgg gat ctg	10800
Gly Val Asp Ala Val Ala Asp Phe Pro Ala Asp Arg Gly Trp Asp Leu	
3585 3590 3595 3600	
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Ala Gly Leu Phe Asp Pro Asp Pro Glu Arg Ala Gly Lys Thr Tyr Val	
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Arg Glu Gly Ala Phe Leu Thr Asp Ala Asp Arg Phe Asp Ala Gly Phe	
3620 3625 3630	
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Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg	
3635 3640 3645	
ctg ttg ctg gag ctg tcc tgg gag gcc att gaa cgg gca ggg atc gat	10992
Leu Leu Leu Glu Leu Ser Trp Glu Ala Ile Glu Arg Ala Gly Ile Asp	
3650 3655 3660	
ccg ggt tcg ctg agg ggg agt cgg acc ggt gtg ttc gcg ggg ctg atg	11040
Pro Gly Ser Leu Arg Gly Ser Arg Thr Gly Val Phe Ala Gly Leu Met	
3665 3670 3675 3680	
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Tyr His Asp Tyr Gly Ala Arg Phe Ala Ser Arg Ala Pro Glu Gly Phe	
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Glu Gly Tyr Leu Gly Asn Gly Ser Ala Gly Ser Val Ala Ser Gly Arg	
3700 3705 3710	
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Ile Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr	
3715 3720 3725	

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Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ser Leu	
3730 3735 3740	
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Arg Ser Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val Met	
3745 3750 3755 3760	
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Ser Thr Pro Gly Thr Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala	
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Pro Asp Gly Arg Cys Lys Ser Phe Ala Glu Ser Ala Asp Gly Thr Gly	
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Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala	
3795 3800 3805	
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Arg Arg Asn Gly His Arg Val Leu Ala Val Val Arg Gly Ser Ala Val	
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Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser	
3825 3830 3835 3840	
cag cag cgg gtc atc cag cag gcg ttg gcg agt gcg ggt ctg tgc gtg	11568
Gln Gln Arg Val Ile Gln Gln Ala Leu Ala Ser Ala Gly Leu Ser Val	
3845 3850 3855	
tcc gat gtg gat gcc gtg gag gcg cat ggg acc ggg acc agg ttg ggt	11616
Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly	
3860 3865 3870	
gat ccg att gag gcg cag gct ctg att gct acg tat ggg cgc gat cgt	11664
Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Arg Asp Arg	
3875 3880 3885	
gat ccc ggt cgg ccg ttg tgg ttg ggg tgc gtg aag tcc aac atc ggt	11712
Asp Pro Gly Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly	
3890 3895 3900	
cat acg cag gcg gcg gcg ggt gtt gcc ggt gtg atc aag atg gtg atg	11760
His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met	
3905 3910 3915 3920	

gcg atg cgg cac ggg caa ctt ccg cgc acg ctg cac gtg gat gca ccc	11808
Ala Met Arg His Gly Gln Leu Pro Arg Thr Leu His Val Asp Ala Pro	
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tcc tcg cag gtg gat tgg tcg gcg ggg agg gtc cag ctc ctg acg gag	11856
Ser Ser Gln Val Asp Trp Ser Ala Gly Arg Val Gln Leu Leu Thr Glu	
3940 3945 3950	
aac acg ccc tgg ccc gac agt ggt cgc ccc tgt cgg gtg ggg gtg tcg	11904
Asn Thr Pro Trp Pro Asp Ser Gly Arg Pro Cys Arg Val Gly Val Ser	
3955 3960 3965	
tcg ttc ggg atc agc ggc acc aac gcg cac gtc atc ctg gaa cag tcc	11952
Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Ser	
3970 3975 3980	
acg ggg cag atg gat cag gca gcg gag ccg gat tcg agt cct gtt ctg	12000
Thr Gly Gln Met Asp Gln Ala Ala Glu Pro Asp Ser Ser Pro Val Leu	
3985 3990 3995 4000	
gat gtt ccg gtg gtg ccg tgg gtg gtg tcg ggc aaa aca ccc gaa gcg	12048
Asp Val Pro Val Val Pro Trp Val Val Ser Gly Lys Thr Pro Glu Ala	
4005 4010 4015	
cta tcc gcc cag gcg gca acg ttg gcg acc tat ttg gac caa aat gtt	12096
Leu Ser Ala Gln Ala Ala Thr Leu Ala Thr Tyr Leu Asp Gln Asn Val	
4020 4025 4030	
gat gtc tcc cct ctg gac gtt ggg att tcg ctt gcg gtg acc cgt tcg	12144
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Asn Leu Asp Asp Val Gly Val Met Ala Thr Pro Glu Tyr Trp Val Arg	
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Ile Pro Leu Val Arg Arg Asp Arg Asp Glu Val Arg Thr Val Leu Asp	
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<400> 50

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 Cys Lys Pro Phe Ala Asp Ala Ala Asp Gly Thr Gly Trp Gly Glu Gly  
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Pro Thr Tyr Pro Phe Gln Arg Gln Arg Tyr Trp Leu Glu Ser Ala Glu  
 900 905 910

Tyr Asp Ala Gly Asp Leu Gly Ser Val Gly Leu Leu Ser Ala Glu His  
 915 920 925

Pro Leu Leu Gly Ala Ala Val Thr Leu Ala Asp Ala Gly Gly Phe Leu  
 930 935 940

Leu Thr Gly Lys Leu Ser Val Lys Thr Gln Pro Trp Leu Ala Asp His  
 945 950 955 960

Val Val Gly Gly Ala Ile Leu Leu Pro Gly Thr Ala Phe Val Glu Met  
 965 970 975

Leu Ile Arg Ala Ala Asp Gln Val Gly Cys Asp Leu Ile Glu Glu Leu  
 980 985 990

Ser Leu Thr Thr Pro Leu Val Leu Pro Ala Thr Gly Ala Val Gln Val  
 995 1000 1005

Gln Ile Ala Val Gly Gly Pro Asp Glu Ala Gly Arg Arg Ser Val Arg  
 1010 1015 1020

Val His Ser Cys Arg Asp Asp Ala Val Pro Gln Asp Ser Trp Thr Cys  
 1025 1030 1035 1040

His Ala Thr Gly Thr Leu Thr Ser Ser Asp His Gln Asp Ala Gly Gln  
 1045 1050 1055

Gly Pro Asp Gly Ile Trp Pro Pro Asn Asp Ala Val Ala Val Pro Leu  
 1060 1065 1070

Asp Ser Phe Tyr Ala Arg Ala Ala Glu Arg Gly Phe Asp Phe Gly Pro  
 1075 1080 1085

Ala Phe Gln Gly Leu Gln Ala Ala Trp Lys Arg Gly Asp Glu Ile Phe  
 1090 1095 1100

Ala Glu Val Gly Leu Pro Thr Ala His Arg Glu Asp Ala Gly Arg Phe  
 1105 1110 1115 1120

Gly Ile His Pro Ala Leu Leu Asp Ala Ala Leu Gln Ala Leu Gly Ala  
 1125 1130 1135

Ala Glu Glu Asp Pro Asp Glu Gly Trp Leu Pro Phe Ala Trp Gln Gly  
 1140 1145 1150

Val Ser Leu Lys Ala Thr Gly Ala Leu Ser Leu Arg Val His Leu Val  
 1155 1160 1165

Pro Ala Gly Ala Asn Ala Val Ser Val Phe Thr Thr Asp Thr Thr Gly  
 1170 1175 1180

Gln Ala Val Leu Ser Ile Asp Ser Leu Val Leu Arg Gln Ile Ser Asp  
 1185 1190 1195 1200

Lys Gln Leu Ala Ala Ala Arg Ala Met Glu His Glu Ser Leu Phe Arg  
 1205 1210 1215

Val Asp Trp Lys Arg Ile Ser Pro Gly Ala Ala Lys Pro Val Ser Trp  
 1220 1225 1230

Ala Val Ile Gly Asn Asp Glu Leu Ala Arg Ala Cys Gly Ser Ala Leu  
 1235 1240 1245

Gly Thr Glu Leu His Pro Asp Leu Thr Gly Leu Ala Asp Pro Pro Pro  
 1250 1255 1260

Asp Val Val Val Val Pro Cys Gly Ala Ser Arg Gln Asp Leu Asp Val  
 1265 1270 1275 1280

Ala Ser Glu Ala Arg Ala Ala Thr Gln Arg Met Leu Asp Leu Ile Gln  
 1285 1290 1295

Asp Trp Leu Ala Ala Ala Arg Phe Ala Gly Ser Arg Leu Val Val Val  
 1300 1305 1310

Thr Cys Gly Ala Ala Ser Thr Gly Pro Ala Glu Gly Val Ser Asp Leu  
 1315 1320 1325

Val His Ala Ala Ser Trp Gly Leu Leu Arg Ser Ala Gln Ser Glu Asn  
 1330 1335 1340

Pro Asp Arg Phe Val Leu Val Asp Val Asp Gly Thr Ala Glu Ser Trp  
 345 1350 1355 1360

Arg Ala Leu Ala Ala Ala Val Arg Ser Gly Glu Pro Gln Leu Ala Leu  
 1365 1370 1375

Arg Ala Gly Glu Val Arg Val Pro Arg Leu Ala Arg Cys Val Ala Ala  
 1380 1385 1390

Glu Asp Ser Arg Ile Pro Val Pro Gly Ala Asp Gly Thr Val Leu Ile  
 1395 1400 1405

Ser Gly Gly Thr Gly Leu Leu Gly Gly Leu Val Ala Arg His Leu Val  
 1410 1415 1420

Ala Glu Arg Gly Val Arg Arg Leu Val Leu Ala Gly Arg Arg Gly Trp  
 425 1430 1435 1440

Ser Ala Pro Gly Val Thr Asp Leu Val Asp Glu Leu Val Gly Leu Gly  
 1445 1450 1455

Ala Ala Val Glu Val Ala Ser Cys Asp Val Gly Asp Arg Ala Gln Leu  
 1460 1465 1470

Asp Arg Leu Leu Thr Thr Ile Ser Ala Glu Phe Pro Leu Arg Gly Val  
 1475 1480 1485

Val His Ala Ala Gly Ala Leu Ala Asp Gly Val Val Glu Ser Leu Thr  
 1490 1495 1500

Pro Glu His Val Ala Lys Val Phe Gly Pro Lys Ala Ala Gly Ala Trp  
 505 1510 1515 1520

His Leu His Glu Leu Thr Leu Asp Leu Asp Leu Ser Phe Phe Val Leu  
 1525 1530 1535

Phe Ser Ser Phe Ser Gly Val Ala Gly Ala Ala Gly Gln Gly Asn Tyr  
 1540 1545 1550

Ala Ala Ala Asn Ala Phe Leu Asp Gly Leu Ala Gln His Arg Arg Thr  
 1555 1560 1565

Ala Gly Leu Pro Ala Val Ser Leu Ala Trp Gly Leu Trp Glu Gln Pro  
 1570 1575 1580

Ser Gly Met Thr Gly Ala Leu Asp Ala Ala Gly Arg Ser Arg Ile Ala  
 585 1590 1595 1600

Arg Thr Asn Pro Pro Met Ser Ala Pro Asp Gly Leu Arg Leu Phe Glu  
 1605 1610 1615

Met Ala Phe Arg Val Pro Gly Glu Ser Leu Leu Val Pro Val His Val  
 1620 1625 1630

Asp Leu Asn Ala Leu Arg Ala Asp Ala Ala Asp Gly Gly Val Pro Ala  
 1635 1640 1645

Leu Leu Arg Asp Leu Val Pro Ala Pro Val Arg Arg Ser Ala Val Asn  
 1650 1655 1660

Glu Ser Ala Asp Val Asn Gly Leu Val Gly Arg Leu Arg Arg Leu Pro  
 665 1670 1675 1680

Asp Leu Asp Gln Glu Thr Gln Leu Leu Gly Leu Val Arg Glu His Val  
 1685 1690 1695

Ser Ala Val Leu Gly His Ser Gly Ala Val Glu Val Gly Ala Asp Arg  
 1700 1705 1710

Ala Phe Arg Asp Leu Gly Phe Asp Ser Leu Ser Gly Val Glu Phe Arg  
 1715 1720 1725

Asn Arg Leu Gly Gly Val Leu Gly Val Arg Leu Pro Ala Thr Ala Val  
 1730 1735 1740

Phe Asp Tyr Pro Thr Pro Arg Ala Leu Val Arg Phe Leu Leu Asp Lys  
 745 1750 1755 1760

Leu Ile Gly Gly Val Glu Ala Pro Thr Pro Ala Pro Ala Ala Val Ala  
 1765 1770 1775

Ala Val Thr Ala Asp Asp Pro Val Val Ile Val Gly Met Gly Cys Arg  
 1780 1785 1790

Tyr Pro Gly Gly Val Ser Ser Pro Glu Glu Leu Trp Arg Leu Val Ala  
 1795 1800 1805

Gly Gly Leu Asp Ala Val Ala Glu Phe Pro Asp Asp Arg Gly Trp Asp  
 1810 1815 1820

Gln Ala Gly Leu Phe Asp Pro Asp Pro Asp Arg Leu Gly Thr Ser Tyr  
 825 1830 1835 1840

Val Cys Glu Gly Gly Phe Leu Arg Asp Ala Ala Glu Phe Asp Ala Gly  
 1845 1850 1855

Phe Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln  
 1860 1865 1870

Arg Leu Leu Leu Glu Val Ala Trp Glu Thr Val Glu Arg Ala Gly Ile  
 1875 1880 1885

Asp Pro Leu Ser Leu Arg Gly Ser Arg Thr Gly Val Phe Ala Gly Leu  
 1890 1895 1900

Met His His Asp Tyr Gly Ala Arg Phe Ile Thr Arg Ala Pro Glu Gly  
 905 1910 1915 1920

Phe Glu Gly Tyr Leu Gly Asn Gly Ser Ala Gly Gly Val Phe Ser Gly  
 1925 1930 1935

Arg Val Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp  
 1940 1945 1950

Thr Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ala  
 1955 1960 1965

Leu Arg Ser Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val  
 1970 1975 1980

Met Ala Thr Pro Gly Met Phe Val Glu Phe Ser Arg Gln Arg Gly Leu  
 985 1990 1995 2000

Ala Ala Asp Gly Arg Cys Lys Ser Phe Ala Ala Ala Ala\*Asp Gly Thr  
 2005 2010 2015

Gly Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp  
 2020 2025 2030

Ala Arg Arg Asn Gly His Ala Val Leu Ala Val Val Arg Gly Ser Ala  
 2035 2040 2045

Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro  
 2050 2055 2060

Ser Gln Gln Arg Val Ile Thr Gln Ala Leu Ala Ser Ala Gly Leu Ser  
 065 2070 2075 2080



Val Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu  
 2085 2090 2095  
 Gly Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Gln Gly  
 2100 2105 2110  
 Arg Asp Ser Asp Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile  
 2115 2120 2125  
 Gly His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val  
 2130 2135 2140  
 Met Ala Met Arg His Gly Gln Leu Pro Ala Thr Leu His Val Asp Glu  
 145 2150 2155 2160  
 Pro Thr Ser Glu Val Asp Trp Ser Ala Gly Asp Val Gln Leu Leu Thr  
 2165 2170 2175  
 Glu Asn Thr Pro Trp Pro Gly Asn Ser His Pro Arg Arg Val Gly Val  
 2180 2185 2190  
 Ser Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln  
 2195 2200 2205  
 Ala Ser Lys Thr Pro Asp Glu Thr Ala Asp Lys Ser Gly Pro Asp Ser  
 2210 2215 2220  
 Glu Ser Thr Val Asp Leu Pro Ala Val Pro Leu Ile Val Ser Gly Arg  
 225 2230 2235 2240  
 Thr Pro Ala Ala Leu Ser Ala Gln Ala Ser Ala Leu Leu Ser Tyr Leu  
 2245 2250 2255  
 Gly Glu Arg Gly Asp Ile Ser Thr Leu Asp Ala Ala Phe Ser Leu Ala  
 2260 2265 2270  
 Ser Ser Arg Ala Ala Leu Glu Glu Arg Ala Val Val Leu Gly Ala Asp  
 2275 2280 2285  
 Arg Glu Thr Leu Leu Ser Gly Leu Glu Ala Leu Ala Ser Gly Arg Glu  
 2290 2295 2300  
 Ala Ser Gly Val Val Ser Gly Ser Pro Val Ser Gly Gly Val Gly Phe  
 305 2310 2315 2320  
 Val Phe Ala Gly Gln Gly Gly Gln Trp Leu Gly Met Gly Arg Gly Leu  
 2325 2330 2335

Tyr Ser Val Phe Pro Val Phe Ala Asp Ala Phe Asp Glu Ala Cys Ala  
 2340 2345 2350

Gly Leu Asp Ala His Leu Gly Gln Asp Val Gly Val Arg Asp Val Val  
 2355 2360 2365

Phe Gly Ser Asp Gly Ser Leu Leu Asp Arg Thr Leu Trp Ala Gln Ser  
 2370 2375 2380

Gly Leu Phe Ala Leu Gln Val Gly Leu Leu Ser Leu Leu Gly Ser Trp  
 385 2390 2395 2400

Gly Val Arg Pro Gly Val Val Leu Gly His Ser Val Gly Glu Phe Ala  
 2405 2410 2415

Ala Ala Val Ala Ala Gly Val Leu Ser Leu Pro Asp Ala Ala Arg Met  
 2420 2425 2430

Val Ala Gly Arg Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Ala  
 2435 2440 2445

Met Leu Ala Val Ala Ala Gly Glu Glu Gln Leu Arg Pro Leu Leu Ala  
 2450 2455 2460

Asp Arg Val Asp Gly Ala Gly Ile Ala Ala Val Asn Ala Pro Glu Ser  
 465 2470 2475 2480

Val Val Leu Ser Gly Asp Arg Glu Val Leu Asp Asp Ile Ala Gly Ala  
 2485 2490 2495

Leu Asp Gly Gln Gly Ile Arg Trp Arg Arg Leu Arg Val Ser His Ala  
 2500 2505 2510

Phe His Ser Tyr Arg Met Asp Pro Met Leu Gln Glu Phe Ala Glu Ile  
 2515 2520 2525

Ala Arg Ser Val Asp Tyr Arg Arg Gly Asp Leu Pro Val Val Ser Thr  
 2530 2535 2540

Leu Thr Gly Glu Leu Asp Thr Ala Gly Val Met Ala Thr Pro Glu Tyr  
 545 2550 2555 2560

Trp Val Arg Gln Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Arg  
 2565 2570 2575

Val Leu Ala Gln Gln Gly Val Ala Thr Ile Phe Glu Leu Gly Pro Asp  
 2580 2585 2590

Ala Thr Leu Ser Ala Leu Ile Pro Asp Cys His Ser Trp Ala Asp Gln  
 2595 2600 2605

Ala Met Pro Ile Pro Met Leu Arg Lys Asp Arg Thr Glu Thr Glu Thr  
 2610 2615 2620

Val Val Ala Ala Val Ala Arg Ala His Thr Arg Gly Val Pro Val Glu  
 625 2630 2635 2640

Trp Ser Ala Tyr Phe Ala Gly Thr Gly Ala Arg Arg Val Glu Leu Pro  
 2645 2650 2655

Thr Tyr Ala Phe Gln Arg Gln Arg Tyr Trp Leu Glu Thr Ser Asp Tyr  
 2660 2665 2670

Gly Asp Val Thr Gly Ile Gly Leu Ala Ala Ala Glu His Pro Leu Leu  
 2675 2680 2685

Gly Ala Val Val Ala Leu Ala Asp Gly Asp Gly Met Val Leu Thr Gly  
 2690 2695 2700

Arg Leu Ser Val Gly Thr His Pro Trp Leu Ala Gln His Arg Val Leu  
 705 2710 2715 2720

Gly Glu Val Val Val Pro Gly Thr Ala Ile Leu Glu Met Ala Leu His  
 2725 2730 2735

Ala Gly Ala Arg Leu Gly Cys Asp Arg Val Glu Glu Leu Thr Leu Glu  
 2740 2745 2750

Thr Pro Leu Val Val Pro Glu Arg Ala Ala Gly Ala Gly Ser Arg Gly  
 2755 2760 2765

Pro Ala Gly Gly Thr Thr Val Ser Ile Glu Thr Ala Glu Glu Arg Val  
 2770 2775 2780

Arg Thr Asn Asp Ala Ile Glu Ile Gln Leu Leu Val Asn Ala Pro Asp  
 785 2790 2795 2800

Glu Gly Gly Arg Arg Arg Val Ser Leu Tyr Ser Arg Pro Ala Gly Gly  
 2805 2810 2815

Ser Arg Gly Gly Gly Trp Thr Arg His Ala Thr Gly Glu Leu Val Val  
 2820 2825 2830

Gly Thr Thr Gly Gly Arg Ala Val Pro Asp Trp Ser Ala Glu Gly Ala  
 2835 2840 2845

Glu Ser Ile Ala Leu Asp Glu Phe Tyr Val Ala Leu Ala Gly Asn Gly  
 2850 2855 2860

Phe Glu Tyr Gly Pro Leu Phe Gln Gly Leu Gln Ala Ala Trp Arg Arg  
 865 2870 2875 2880

Gly Asp Glu Val Leu Ala Glu Ile Ala Pro Pro Ala Glu Ala Asp Ala  
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Met Ala Ser Gly Tyr Leu Leu Asp Pro Ala Leu Leu Asp Ala Ala Leu  
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Gln Ala Ser Ala Leu Gly Asp Arg Pro Glu Gln Gly Gly Ala Trp Leu  
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Pro Phe Ser Phe Thr Gly Val Glu Leu Ser Ala Pro Ala Gly Thr Ile  
 2930 2935 2940

Ser Arg Val Arg Leu Glu Thr Arg Arg Pro Asp Ala Ile Ser Val Ala  
 945 2950 2955 2960

Val Met Asp Glu Ser Gly Arg Leu Leu Ala Ser Ile Asp Ser Leu Arg  
 2965 2970 2975

Leu Arg Ser Val Ser Ser Gly Gln Leu Ala Asn Arg Asp Ala Val Arg  
 2980 2985 2990

Asp Ala Leu Phe Glu Val Thr Trp Glu Pro Val Ala Thr Gln Ser Thr  
 2995 3000 3005

Glu Pro Gly Arg Trp Ala Leu Leu Gly Asp Thr Ala Cys Gly Lys Asp  
 3010 3015 3020

Asp Leu Ile Lys Leu Ala Thr Asp Ser Ala Asp Arg Cys Ala Asp Leu  
 025 3030 3035 3040

Ala Ala Leu Ala Glu Lys Leu Asp Ser Ser Ala Leu Val Pro Asp Val  
 3045 3050 3055

Val Val Tyr Cys Ala Gly Glu Gln Ala Asp Pro Gly Thr Gly Ala Ala  
 3060 3065 3070

Ala Leu Ala Glu Thr Gln Gln Thr Leu Ala Leu Leu Gln Ala Trp Leu  
 3075 3080 3085

Ala Glu Pro Arg Leu Ala Glu Ala Arg Leu Val Val Val Thr Cys Ala  
 3090 3095 3100

Ala Val Thr Thr Ala Pro Ser Asp Gly Ala Ser Glu Leu Ala His Ala  
 105 3110 3115 3120

Pro Leu Trp Gly Leu Leu Arg Ala Ala Gln Val Glu Asn Pro Gly Gln  
 3125 3130 3135

Phe Val Leu Ala Asp Val Asp Gly Thr Ala Glu Ser Trp Arg Ala Leu  
 3140 3145 3150

Pro Ser Ala Leu Gly Ser Met Glu Pro Gln Leu Ala Leu Arg Lys Gly  
 3155 3160 3165

Ala Val Arg Ala Pro Arg Leu Ala Ser Val Ala Gly Gln Ile Asp Val  
 3170 3175 3180

Pro Ala Val Val Ala Asp Pro Asp Arg Thr Val Leu Ile Ser Gly Gly  
 185 3190 3195 3200

Thr Gly Leu Leu Gly Gly Ala Val Ala Arg His Leu Val Thr Glu Arg  
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Gly Val Arg Arg Leu Val Leu Thr Gly Arg Arg Gly Trp Asp Ala Pro  
 3220 3225 3230

Gly Ile Thr Glu Leu Val Gly Glu Leu Asn Gly Leu Gly Ala Val Val  
 3235 3240 3245

Asp Val Val Ala Cys Asp Val Ala Asp Arg Ala Asp Leu Glu Ser Leu  
 3250 3255 3260

Leu Ala Ala Val Pro Ala Glu Phe Pro Leu Cys Gly Val Val His Ala  
 265 3270 3275 3280

Ala Gly Ala Leu Ala Asp Gly Val Ile Glu Ser Leu Ser Pro Asp Asp  
 3285 3290 3295

Val Gly Ala Val Phe Gly Pro Lys Ala Ala Gly Ala Trp Asn Leu His  
 3300 3305 3310

Glu Leu Thr Arg Asp Thr Asp Leu Ser Phe Phe Ala Leu Phe Ser Ser  
 3315 3320 3325

Leu Ser Gly Val Ala Gly Ala Pro Gly Gln Gly Asn Tyr Ala Ala Ala  
 3330 3335 3340

Asn Ala Phe Leu Asp Ala Leu Ala His Tyr Arg Arg Ser Gln Gly Leu  
 345 3350 3355 3360

Pro Ala Val Ser Leu Ala Trp Gly Leu Trp Glu Gln Pro Ser Gly Met  
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 Thr Glu Thr Leu Ser Glu Val Asp Arg Ser Arg Ile Ala Arg Ala Asn  
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 Pro Pro Leu Ser Thr Lys Glu Gly Leu Arg Leu Phe Asp Ala Gly Leu  
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 Val Leu Gly Tyr Ser Ser Ala Ala Asp Val Gly Val Glu Arg Ala Phe  
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 Tyr Pro Thr Pro Arg Ala Leu Ala Arg Phe Leu His Gln Glu Leu Ala  
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 Asp Glu Ile Ala Thr Thr Pro Ala Pro Val Thr Thr Thr Arg Ala Pro  
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 Val Ala Glu Asp Asp Leu Val Ala Ile Val Gly Met Gly Cys Arg Phe  
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 Pro Gly Gln Val Ser Ser Pro Glu Glu Leu Trp Arg Leu Val Ala Gly  
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 Gly Val Asp Ala Val Ala Asp Phe Pro Ala Asp Arg Gly Trp Asp Leu  
 585 3590 3595 3600  
 Ala Gly Leu Phe Asp Pro Asp Pro Glu Arg Ala Gly Lys Thr Tyr Val  
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Arg Glu Gly Ala Phe Leu Thr Asp Ala Asp Arg Phe Asp Ala Gly Phe  
3620 3625 3630

Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg  
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Leu Leu Leu Glu Leu Ser Trp Glu Ala Ile Glu Arg Ala Gly Ile Asp  
3650 3655 3660

Pro Gly Ser Leu Arg Gly Ser Arg Thr Gly Val Phe Ala Gly Leu Met  
665 3670 3675 3680

Tyr His Asp Tyr Gly Ala Arg Phe Ala Ser Arg Ala Pro Glu Gly Phe  
3685 3690 3695

Glu Gly Tyr Leu Gly Asn Gly Ser Ala Gly Ser Val Ala Ser Gly Arg  
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Ile Ala Tyr Ser Phe Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr  
3715 3720 3725

Ala Cys Ser Ser Ser Leu Val Ala Leu His Leu Ala Gly Gln Ser Leu  
3730 3735 3740

Arg Ser Gly Glu Cys Asp Leu Ala Leu Ala Gly Gly Val Thr Val Met  
745 3750 3755 3760

Ser Thr Pro Gly Thr Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala  
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Pro Asp Gly Arg Cys Lys Ser Phe Ala Glu Ser Ala Asp Gly Thr Gly  
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Trp Gly Glu Gly Ala Gly Leu Val Leu Leu Glu Arg Leu Ser Asp Ala  
3795 3800 3805

Arg Arg Asn Gly His Arg Val Leu Ala Val Val Arg Gly Ser Ala Val  
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Asn Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser  
825 3830 3835 3840

Gln Gln Arg Val Ile Gln Gln Ala Leu Ala Ser Ala Gly Leu Ser Val  
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Ser Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Arg Leu Gly  
3860 3865 3870

Asp Pro Ile Glu Ala Gln Ala Leu Ile Ala Thr Tyr Gly Arg Asp Arg  
 3875 3880 3885

Asp Pro Gly Arg Pro Leu Trp Leu Gly Ser Val Lys Ser Asn Ile Gly  
 3890 3895 3900

His Thr Gln Ala Ala Ala Gly Val Ala Gly Val Ile Lys Met Val Met  
 905 3910 3915 3920

Ala Met Arg His Gly Gln Leu Pro Arg Thr Leu His Val Asp Ala Pro  
 3925 3930 3935

Ser Ser Gln Val Asp Trp Ser Ala Gly Arg Val Gln Leu Leu Thr Glu  
 3940 3945 3950

Asn Thr Pro Trp Pro Asp Ser Gly Arg Pro Cys Arg Val Gly Val Ser  
 3955 3960 3965

Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Ser  
 3970 3975 3980

Thr Gly Gln Met Asp Gln Ala Ala Glu Pro Asp Ser Ser Pro Val Leu  
 985 3990 3995 4000

Asp Val Pro Val Val Pro Trp Val Val Ser Gly Lys Thr Pro Glu Ala  
 4005 4010 4015

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Ala Leu Asp Glu Arg Ala Val Val Leu Gly Ser Asp Arg Asp Thr Leu  
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Leu Ser Gly Leu Asn Ala Leu Ala Ala Gly His Glu Ala Ala Gly Val  
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Val Thr Gly Pro Val Gly Ile Gly Gly Arg Thr Gly Phe Val Phe Ala  
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Gly Gln Gly Gly Gln Trp Leu Gly Met Gly Arg Arg Leu Tyr Ser Glu  
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Phe Pro Ala Phe Ala Gly Ala Phe Asp Glu Ala Cys Ala Glu Leu Asp  
 4115 4120 4125



Ala Asn Leu Gly Arg Glu Val Gly Val Arg Asp Val Val Phe Gly Ser  
 4130 4135 4140

Asp Glu Ser Leu Leu Asp Arg Thr Leu Trp Ala Gln Ser Gly Leu Phe  
 145 4150 4155 4160

Ala Leu Gln Val Gly Leu Trp Glu Leu Leu Gly Thr Trp Gly Val Arg  
 4165 4170 4175

Pro Ser Val Val Leu Gly His Ser Val Gly Glu Leu Ala Ala Ala Phe  
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Ala Ala Gly Val Leu Ser Met Ala Glu Ala Ala Arg Leu Val Ala Gly  
 4195 4200 4205

Arg Ala Arg Leu Met Gln Ala Leu Pro Ser Gly Gly Ala Met Leu Ala  
 4210 4215 4220

Val Ser Ala Thr Glu Ala Arg Val Gly Pro Leu Leu Asp Gly Val Arg  
 225 4230 4235 4240

Asp Arg Val Gly Val Ala Ala Val Asn Ala Pro Gly Ser Val Val Leu  
 4245 4250 4255

Ser Gly Asp Arg Asp Val Leu Asp Gly Ile Ala Gly Arg Leu Asp Gly  
 4260 4265 4270

Gln Gly Ile Arg Ser Arg Trp Leu Arg Val Ser His Ala Phe His Ser  
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His Arg Met Asp Pro Met Leu Ala Glu Phe Ala Glu Leu Ala Arg Ser  
 4290 4295 4300

Val Asp Tyr Arg Ser Pro Arg Leu Pro Ile Val Ser Thr Leu Thr Gly  
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Asn Leu Asp Asp Val Gly Val Met Ala Thr Pro Glu Tyr Trp Val Arg  
 4325 4330 4335

Gln Val Arg Glu Pro Val Arg Phe Ala Asp Gly Val Gln Ala Leu Val  
 4340 4345 4350

Asp Gln Gly Val Asp Thr Ile Val Glu Leu Gly Pro Asp Gly Ala Leu  
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Ser Ser Leu Val Gln Glu Cys Val Ala Glu Ser Gly Arg Ala Thr Gly  
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Ile Pro Leu Val Arg Arg Asp Arg Asp Glu Val Arg Thr Val Leu Asp  
 385 4390 4395 4400

Ala Leu Ala Gln Thr His Thr Arg Gly Gly Ala Val Asp Trp Gly Ser  
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Phe Phe Ala Gly Thr Arg Ala Thr Gln Val Asp Leu Pro Thr Tyr Ala  
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Phe Gln Arg Gln Arg Tyr Trp Leu Glu Pro Ser Asp Ser Gly Asp Val  
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Thr Gly Val Gly Leu Thr Gly Ala Glu His Pro Leu Leu Gly Ala Val  
 4450 4455 4460

Val Pro Val Ala Gly Gly Asp Glu Val Leu Leu Thr Gly Arg Leu Ser  
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Val Gly Thr His Pro Trp Leu Ala Glu His Arg Val Leu Gly Glu Val  
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Val Val Pro Gly Thr Ala Leu Leu Glu Met Ala Trp Arg Ala Gly Ser  
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Gln Val Gly Cys Glu Arg Val Glu Glu Leu Thr Leu Glu Ala Pro Leu  
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Val Leu Pro Glu Arg Gly Ala Ala Ala Val Gln Leu Ala Val Gly Ala  
 4530 4535 4540

Pro Asp Glu Ala Gly Arg Arg Ser Leu Gln Leu Tyr Ser Arg Gly Ala  
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Asp Glu Asp Gly Asp Trp Arg Arg Ile Ala Ser Gly Leu Leu Ala Gln  
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Ala Asn Ala Val Pro Pro Ala Asp Ser Thr Ala Trp Pro Pro Asp Gly  
 4580 4585 4590

Ala Gly Gln Val Asp Leu Ala Glu Phe Tyr Glu Arg Leu Ala Glu Arg  
 4595 4600 4605

Gly Leu Thr Tyr Gly Pro Val Phe Gln Gly Leu Arg Ala Ala Trp Arg  
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His Gly Asp Asp Ile Phe Ala Glu Leu Ala Gly Ser Pro Asp Ala Ser  
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Gly Phe Gly Ile His Pro Ala Leu Leu Asp Ala Ala Leu His Ala Met  
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 Ala Leu Gly Ala Ser Pro Asp Ser Glu Ala Arg Leu Pro Phe Ser Trp  
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 Arg Gly Ala Gln Leu Tyr Arg Ala Glu Gly Ala Ala Leu Arg Val Arg  
 4675 4680 4685  
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 4690 4695 4700  
 Thr Gly Arg Arg Val Ala Ala Val Glu Ser Leu Ser Thr Arg Pro Val  
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 Ser Thr Asp Gln Ile Gly Ala Gly Arg Gly Asp Gln Glu Arg Leu Leu  
 4725 4730 4735  
 His Val Glu Trp Val Arg Ser Ala Glu Ser Ala Gly Met Ser Leu Thr  
 4740 4745 4750  
 Ser Cys Ala Val Val Gly Leu Gly Glu Pro Glu Trp His Ala Ala Leu  
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 Lys Thr Thr Gly Val Gln Val Glu Ser His Ala Asp Leu Ala Ser Leu  
 4770 4775 4780  
 Ala Thr Glu Val Ala Lys Arg Gly Ser Ala Pro Gly Ala Val Ile Val  
 785 4790 4795 4800  
 Pro Cys Pro Arg Pro Arg Ala Met Gln Glu Leu Pro Thr Ala Ala Arg  
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 Arg Ala Thr Gln Gln Ala Met Ala Met Leu Gln Gln Trp Leu Ala Asp  
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 Asp Arg Phe Val Ser Thr Arg Leu Ile Leu Leu Thr His Arg Ala Val  
 4835 4840 4845  
 Ser Ala Val Ala Gly Glu Asp Val Leu Asp Leu Val His Ala Pro Leu  
 4850 4855 4860  
 Trp Gly Leu Val Arg Ser Ala Gln Ala Glu His Pro Asp Arg Phe Ala  
 865 4870 4875 4880  
 Leu Ile Asp Met Asp Asp Glu Arg Ala Ser Gln Thr Ala Leu Ala Glu  
 4885 4890 4895

Ala Leu Thr Ala Gly Glu Ala Gln Leu Ala Val Arg Ser Gly Val Val  
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Leu Ala Pro Arg Leu Gly Gln Val Lys Val Ser Gly Gly Glu Ala Phe  
 4915 4920 4925

Arg Trp Asp Glu Gly Thr Val Leu Val Thr Gly Gly Thr Gly Gly Leu  
 4930 4935 4940

Gly Ala Leu Leu Ala Arg His Leu Val Ser Ala His Gly Val Arg His  
 945 4950 4955 4960

Leu Leu Leu Ala Ser Arg Arg Gly Leu Ala Ala Pro Gly Ala Asp Glu  
 4965 4970 4975

Leu Val Ala Glu Leu Glu Gln Ala Gly Ala Asp Val Ala Val Val Ala  
 4980 4985 4990

Cys Asp Ser Ala Asp Arg Asp Ser Leu Ala Arg Leu Val Ala Ser Val  
 4995 5000 5005

Pro Ala Glu Asn Pro Leu Arg Val Val Val His Ala Ala Gly Val Leu  
 5010 5015 5020

Asp Asp Gly Val Leu Met Ser Met Ser Pro Glu Arg Leu Asp Ala Val  
 025 5030 5035 5040

Leu Arg Pro Lys Val Asp Ala Ala Trp Tyr Leu His Glu Leu Thr Arg  
 5045 5050 5055

Glu Leu Gly Leu Ser Ala Phe Val Leu Phe Ser Ser Val Ala Gly Leu  
 5060 5065 5070

Phe Gly Gly Ala Gly Gln Ser Asn Tyr Ala Ala Gly Asn Ala Phe Leu  
 5075 5080 5085

Asp Ala Leu Ala His Cys Arg Gln Ala Gln Gly Leu Pro Ala Leu Ser  
 5090 5095 5100

Leu Ala Ser Gly Leu Trp Ala Ser Ile Asp Gly Met Ala Gly Asp Leu  
 105 5110 5115 5120

Ala Ala Ala Asp Val Glu Arg Leu Ser Arg Ala Gly Ile Gly Pro Leu  
 5125 5130 5135

Ser Ala Pro Gly Gly Leu Ala Leu Phe Asp Ala Ala Val Gly Ser Asp  
 5140 5145 5150

Glu Pro Leu Leu Ala Pro Val Arg Leu Asp Val Glu Ala Leu Arg Val  
5155 5160 5165

Gln Ala Arg Ser Val Gln Thr Arg Ile Pro Glu Met Leu His Gly Met  
5170 5175 5180

Ala Met Gly Pro Ser Arg Arg Thr Pro Phe Thr Ser Arg Val Glu Pro  
185 5190 5195 5200

Leu His Glu Arg Leu Ala Gly Leu Ser Glu Gly Glu Arg Arg Gln Gln  
5205 5210 5215

Val Leu Gln Arg Val Arg Ala Asp Ile Ala Val Val Leu Gly His Gly  
5220 5225 5230

Arg Ser Ser Asp Val Asp Ile Glu Lys Pro Leu Ala Glu Leu Gly Phe  
5235 5240 5245

Asp Ser Leu Thr Ala Ile Glu Leu Arg Asn Arg Leu Ala Thr Ala Thr  
5250 5255 5260

Gly Leu Arg Leu Pro Ala Thr Leu Ala Phe Asp His Gly Thr Ala Ala  
265 5270 5275 5280

Ala Leu Ala Gln His Val Cys Ala Gln Leu Gly Thr Ala Thr Ala Pro  
5285 5290 5295

Ala Pro Arg Arg Thr Asp Asp Asn Asp Ala Thr Glu Pro Val Arg Ser  
5300 5305 5310

Leu Phe Gln Gln Ala Tyr Ala Ala Gly Arg Ile Leu Asp Gly Met Asp  
5315 5320 5325

Leu Val Lys Val Ala Ala Gln Leu Arg Pro Val Phe Gly Ser Pro Gly  
5330 5335 5340

Glu Leu Glu Ser Leu Pro Lys Pro Val Gln Leu Ser Arg Gly Pro Glu  
345 5350 5355 5360

Glu Leu Ala Leu Val Cys Met Pro Ala Leu Ile Gly Met Pro Pro Ala  
5365 5370 5375

Gln Gln Tyr Ala Arg Ile Ala Ala Gly Phe Arg Asp Val Arg Asp Val  
5380 5385 5390

Ser Val Ile Pro Met Pro Gly Phe Ile Ala Gly Glu Pro Leu Pro Ser  
5395 5400 5405

Ala Ile Glu Val Ala Val Arg Thr Gln Ala Glu Ala Val Leu Gln Glu  
5410 5415 5420

Phe Ala Gly Gly Ser Phe Val Leu Val Gly His Ser Ser Gly Gly Trp  
425 5430 5435 5440

Leu Ala His Glu Val Ala Gly Glu Leu Glu Arg Arg Gly Val Val Pro  
5445 5450 5455

Ala Gly Val Val Leu Leu Asp Thr Tyr Ile Pro Gly Glu Ile Thr Pro  
5460 5465 5470

Arg Phe Ser Val Ala Met Ala His Arg Thr Tyr Glu Lys Leu Ala Thr  
5475 5480 5485

Phe Thr Asp Met Gln Asp Val Gly Ile Thr Ala Met Gly Gly Tyr Phe  
5490 5495 5500

Arg Met Phe Thr Glu Trp Thr Pro Thr Pro Ile Gly Ala Pro Thr Leu  
505 5510 5515 5520

Phe Val Arg Thr Glu Asp Cys Val Ala Asp Pro Glu Gly Arg Pro Trp  
5525 5530 5535

Thr Asp Asp Ser Trp Arg Pro Gly Trp Thr Leu Ala Asp Ala Thr Val  
5540 5545 5550

Gln Val Pro Gly Asp His Phe Ser Met Met Asp Glu His Ala Gly Ser  
5555 5560 5565

Thr Ala Gln Ala Val Ala Ser Trp Leu Asp Lys Leu Asn Gln Arg Thr  
5570 5575 5580

Ala Arg Gln Arg  
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<210> 51

<211> 2363

<212> DNA

<213> Saccharopolyspora spinosa

<400> 51

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ttacagtttc gggaagtgat ttgctcgtg ttccgaatgc aggctagcgg tggtcctggg 180

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gcggttgggc aggtcccagc aacagtgggtg atatccctca taagggcgaa gcgacttcgt 240
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cggacctgca gcgggcccgc aaatcccggc gaggaagggc gcgatgcgga ttctgggtcac 360
cggcggagcc ggtttcatcg gctcgcaacta cgttcggcag ttgctcgggtg gtgcgtaccc 420
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caccaacgtg ctgctgcagg ccgcgctcga cgcgagatc ggcaagttcg tgcacgtttc 720
caccgacgag gtctacggct ccatcgagga cggctcgtgg cccgaagacc acgcgctgga 780
gccgaattcc ccgtactcgg cggcgaaagc gggctcggac ctgctggccc gcgcctacca 840
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2363

&lt;210&gt; 52

&lt;211&gt; 990

&lt;212&gt; DNA

<213> *Saccharopolyspora spinosa*

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1) .. (987)

&lt;223&gt; ORF23; dNTP-Glucose-4,6-Dehydratase

&lt;400&gt; 52

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Met Arg Ile Leu Val Thr Gly Gly Ala Gly Phe Ile Gly Ser His Tyr	
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gtt cgg cag ttg ctc ggt ggt gcg tac ccc gca ttc gcc gac gcc gac	96
Val Arg Gln Leu Leu Gly Gly Ala Tyr Pro Ala Phe Ala Asp Ala Asp	
20 25 30	
gtg gtc gtg ctc gac aag ctc acc tac gcc ggc aac gag gcg aac ctg	144
Val Val Val Leu Asp Lys Leu Thr Tyr Ala Gly Asn Glu Ala Asn Leu	
35 40 45	
gcg ccg gtc gcg gac aac ccc cgg ctg aag ttc gtc tgc ggc gac atc	192
Ala Pro Val Ala Asp Asn Pro Arg Leu Lys Phe Val Cys Gly Asp Ile	
50 55 60	
tgc gac cgc gaa ctg gtt ggc ggc ctg atg tcc ggc gtg gac gtg gtg	240
Cys Asp Arg Glu Leu Val Gly Gly Leu Met Ser Gly Val Asp Val Val	
65 70 75 80	
gtg cac ttc gcc gcc gaa acc cac gtc gac cgc tcg atc acc ggc tcg	288
Val His Phe Ala Ala Glu Thr His Val Asp Arg Ser Ile Thr Gly Ser	
85 90 95	
gac gcc ttc gtg atc acc aac gtg gtc ggc acc aac gtg ctg ctg cag	336
Asp Ala Phe Val Ile Thr Asn Val Val Gly Thr Asn Val Leu Leu Gln	
100 105 110	
gcc gcg ctc gac gcc gag atc ggc aag ttc gtg cac gtt tcc acc gac	384
Ala Ala Leu Asp Ala Glu Ile Gly Lys Phe Val His Val Ser Thr Asp	
115 120 125	
gag gtc tac ggc tcc atc gag gac ggc tcg tgg ccc gaa gac cac gcg	432
Glu Val Tyr Gly Ser Ile Glu Asp Gly Ser Trp Pro Glu Asp His Ala	
130 135 140	
ctg gag ccg aat tcc ccg tac tcg gcg gcg aaa gcg ggc tcg gac ctg	480
Leu Glu Pro Asn Ser Pro Tyr Ser Ala Ala Lys Ala Gly Ser Asp Leu	
145 150 155 160	
ctg gcc cgc gcc tac cac cgc acc cac gga ctg ccg gtg tgc atc acc	528
Leu Ala Arg Ala Tyr His Arg Thr His Gly Leu Pro Val Cys Ile Thr	
165 170 175	
cgc tgc tcc aac aac tac ggg ccc tac cag ttc ccg gag aag gtg ctg	576
Arg Cys Ser Asn Asn Tyr Gly Pro Tyr Gln Phe Pro Glu Lys Val Leu	



180	185	190	
ccg ctg ttc atc acg aac ctg atg gac ggc agc cag gtg ccg ctc tac			624
Pro Leu Phe Ile Thr Asn Leu Met Asp Gly Ser Gln Val Pro Leu Tyr			
195	200	205	
ggc gac ggg ctc aac gtg cgg gac tgg ctg cac gtc agc gac cac tgc			672
Gly Asp Gly Leu Asn Val Arg Asp Trp Leu His Val Ser Asp His Cys			
210	215	220	
cgg ggc atc cag ctg gtg gcc gac tcc ggg cgc gcg ggc gag atc tac			720
Arg Gly Ile Gln Leu Val Ala Asp Ser Gly Arg Ala Gly Glu Ile Tyr			
225	230	235	240
aac atc ggc ggc ggc acc gag ctg acc aac aac gag ctg acc gag cgg			768
Asn Ile Gly Gly Gly Thr Glu Leu Thr Asn Asn Glu Leu Thr Glu Arg			
245	250	255	
ctg ctg gca gag ctg ggc ctc gac tgg tcg gtg gtg cgg ccg gtc acc			816
Leu Leu Ala Glu Leu Gly Leu Asp Trp Ser Val Val Arg Pro Val Thr			
260	265	270	
gac cgc aag ggc cac gac cgc cgc tac tcg gtg gac cac agc aag atc			864
Asp Arg Lys Gly His Asp Arg Arg Tyr Ser Val Asp His Ser Lys Ile			
275	280	285	
gtc gag gaa ctg ggg tac gcg ccg cag gtc gac ttc gag acc ggg ctg			912
Val Glu Glu Leu Gly Tyr Ala Pro Gln Val Asp Phe Glu Thr Gly Leu			
290	295	300	
cgc gag aca atc cgc tgg tac cag gac aac cgg gac tgg tgg gag ccg			960
Arg Glu Thr Ile Arg Trp Tyr Gln Asp Asn Arg Asp Trp Trp Glu Pro			
305	310	315	320
ctg aag gcc cga tcg gcg gtg gct cga tga			990
Leu Lys Ala Arg Ser Ala Val Ala Arg			
325			

&lt;210&gt; 53

&lt;211&gt; 329

&lt;212&gt; PRT

&lt;213&gt; Saccharopolyspora spinosa

&lt;400&gt; 53

Met Arg Ile Leu Val Thr Gly Gly Ala Gly Phe Ile Gly Ser His Tyr

1

5

10

15

Val Arg Gln Leu Leu Gly Gly Ala Tyr Pro Ala Phe Ala Asp Ala Asp  
 20 25 30

Val Val Val Leu Asp Lys Leu Thr Tyr Ala Gly Asn Glu Ala Asn Leu  
 35 40 45

Ala Pro Val Ala Asp Asn Pro Arg Leu Lys Phe Val Cys Gly Asp Ile  
 50 55 60

Cys Asp Arg Glu Leu Val Gly Gly Leu Met Ser Gly Val Asp Val Val  
 65 70 75 80

Val His Phe Ala Ala Glu Thr His Val Asp Arg Ser Ile Thr Gly Ser  
 85 90 95

Asp Ala Phe Val Ile Thr Asn Val Val Gly Thr Asn Val Leu Leu Gln  
 100 105 110

Ala Ala Leu Asp Ala Glu Ile Gly Lys Phe Val His Val Ser Thr Asp  
 115 120 125

Glu Val Tyr Gly Ser Ile Glu Asp Gly Ser Trp Pro Glu Asp His Ala  
 130 135 140

Leu Glu Pro Asn Ser Pro Tyr Ser Ala Ala Lys Ala Gly Ser Asp Leu  
 145 150 155 160

Leu Ala Arg Ala Tyr His Arg Thr His Gly Leu Pro Val Cys Ile Thr  
 165 170 175

Arg Cys Ser Asn Asn Tyr Gly Pro Tyr Gln Phe Pro Glu Lys Val Leu  
 180 185 190

Pro Leu Phe Ile Thr Asn Leu Met Asp Gly Ser Gln Val Pro Leu Tyr  
 195 200 205

Gly Asp Gly Leu Asn Val Arg Asp Trp Leu His Val Ser Asp His Cys  
 210 215 220

Arg Gly Ile Gln Leu Val Ala Asp Ser Gly Arg Ala Gly Glu Ile Tyr  
 225 230 235 240

Asn Ile Gly Gly Gly Thr Glu Leu Thr Asn Asn Glu Leu Thr Glu Arg  
 245 250 255

Leu Leu Ala Glu Leu Gly Leu Asp Trp Ser Val Val Arg Pro Val Thr  
 260 265 270

Asp Arg Lys Gly His Asp Arg Arg Tyr Ser Val Asp His Ser Lys Ile  
 275 280 285

Val Glu Glu Leu Gly Tyr Ala Pro Gln Val Asp Phe Glu Thr Gly Leu  
 290 295 300

Arg Glu Thr Ile Arg Trp Tyr Gln Asp Asn Arg Asp Trp Trp Glu Pro  
 305 310 315 320

Leu Lys Ala Arg Ser Ala Val Ala Arg  
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<210> 54

<211> 918

<212> DNA

<213> Saccharopolyspora spinosa

<220>

<221> CDS

<222> (1)..(915)

<223> ORF24; dNTP-4-keto-6-Deoxyglucose-3,5-Epimerase

<400> 54

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 Met Ser Arg Leu Ala Val Leu Val Pro Gly Gly Arg Gly Gln Leu Gly  
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tcg gag ctg gcc cgg atc ctc ccc gcg cgg acg ggg gcg ctg gtg cac 96  
 Ser Glu Leu Ala Arg Ile Leu Pro Ala Arg Thr Gly Ala Leu Val His  
 20 25 30

cgg ccg ggt tcc ggg gaa ctg gac gtc acc gac gcc gag gag gtc gcc 144  
 Arg Pro Gly Ser Gly Glu Leu Asp Val Thr Asp Ala Glu Glu Val Ala  
 35 40 45

gac gcg ttg ggt tcc ttc gcg gag acg gcg aag gac gcg gag ctg cga 192  
 Asp Ala Leu Gly Ser Phe Ala Glu Thr Ala Lys Asp Ala Glu Leu Arg  
 50 55 60

ccg gtg gtg atc aac gcc gcg gcg tac acg gcg gtg gac gcg gcc gag 240  
 Pro Val Val Ile Asn Ala Ala Ala Tyr Thr Ala Val Asp Ala Ala Glu  
 65 70 75 80

tcc gac ccg gac cgc gcg gcc cgg atc aac gcc gaa ggc gcg gcc tcg 288  
 Ser Asp Pro Asp Arg Ala Ala Arg Ile Asn Ala Glu Gly Ala Ala Ser  
 85 90 95

ctg gcg aaa gcg tgc cgg agc agc ggt ctg ccc ctg gtg cac gtg tcg	336
Leu Ala Lys Ala Cys Arg Ser Ser Gly Leu Pro Leu Val His Val Ser	
100 105 110	
acg gat tac gtg ttc ccc ggt gat ggg gcc cgg ccg tac gag ccg acg	384
Thr Asp Tyr Val Phe Pro Gly Asp Gly Ala Arg Pro Tyr Glu Pro Thr	
115 120 125	
gac ccg acc ggg ccg cga tgc gtc tac ggg cgc acc aag ctc gaa ggc	432
Asp Pro Thr Gly Pro Arg Ser Val Tyr Gly Arg Thr Lys Leu Glu Gly	
130 135 140	
gaa cgg gcc gtg ctg gag tcc ggc gcg cgg gcc tgg gtg gtg cgc acg	480
Glu Arg Ala Val Leu Glu Ser Gly Ala Arg Ala Trp Val Val Arg Thr	
145 150 155 160	
gca tgg gtg tac ggc gcg agc ggc aag aac ttc ctg aaa acg atg atc	528
Ala Trp Val Tyr Gly Ala Ser Gly Lys Asn Phe Leu Lys Thr Met Ile	
165 170 175	
cgc ctc tcg ggg gag cgc gac acg ctg tcc gtt gtg gac gat cag atc	576
Arg Leu Ser Gly Glu Arg Asp Thr Leu Ser Val Val Asp Asp Gln Ile	
180 185 190	
ggc tcg ccg act tgg gcg gcg gac ctg gcg agc ggc ctg ctg gag ctg	624
Gly Ser Pro Thr Trp Ala Ala Asp Leu Ala Ser Gly Leu Leu Glu Leu	
195 200 205	
gcc gaa cgg gtc gcc gaa cgc cgt gga ccg gag cag aag gtg ctg cac	672
Ala Glu Arg Val Ala Glu Arg Arg Gly Pro Glu Gln Lys Val Leu His	
210 215 220	
tgc acc aat tcc ggc cag gtg acc tgg tac gag ttc gcg cgg gcg atc	720
Cys Thr Asn Ser Gly Gln Val Thr Trp Tyr Glu Phe Ala Arg Ala Ile	
225 230 235 240	
ttc gcg gaa ttc ggc ctg gac gag aac cgc gtc cac ccg tgc acg acg	768
Phe Ala Glu Phe Gly Leu Asp Glu Asn Arg Val His Pro Cys Thr Thr	
245 250 255	
gcg gac ttc ccc ctc ccg gcg cac cgc ccg gcc tac tcg gtc ctg tcc	816
Ala Asp Phe Pro Leu Pro Ala His Arg Pro Ala Tyr Ser Val Leu Ser	
260 265 270	
gac gtg gcg tgg cga gag gcg ggc ctg acc ccg atg cgc acc tgg cgg	864
Asp Val Ala Trp Arg Glu Ala Gly Leu Thr Pro Met Arg Thr Trp Arg	
275 280 285	

gaa gcc ctg gcg gcg gcc ttc gag aaa gac ggc gaa acc ctc cga acc 912  
 Glu Ala Leu Ala Ala Ala Phe Glu Lys Asp Gly Glu Thr Leu Arg Thr  
 290 295 300

cgc tga 918  
 Arg  
 305

<210> 55

<211> 305

<212> PRT

<213> Saccharopolyspora spinosa

<400> 55

Met Ser Arg Leu Ala Val Leu Val Pro Gly Gly Arg Gly Gln Leu Gly  
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Ser Glu Leu Ala Arg Ile Leu Pro Ala Arg Thr Gly Ala Leu Val His  
 20 25 30

Arg Pro Gly Ser Gly Glu Leu Asp Val Thr Asp Ala Glu Glu Val Ala  
 35 40 45

Asp Ala Leu Gly Ser Phe Ala Glu Thr Ala Lys Asp Ala Glu Leu Arg  
 50 55 60

Pro Val Val Ile Asn Ala Ala Ala Tyr Thr Ala Val Asp Ala Ala Glu  
 65 70 75 80

Ser Asp Pro Asp Arg Ala Ala Arg Ile Asn Ala Glu Gly Ala Ala Ser  
 85 90 95

Leu Ala Lys Ala Cys Arg Ser Ser Gly Leu Pro Leu Val His Val Ser  
 100 105 110

Thr Asp Tyr Val Phe Pro Gly Asp Gly Ala Arg Pro Tyr Glu Pro Thr  
 115 120 125

Asp Pro Thr Gly Pro Arg Ser Val Tyr Gly Arg Thr Lys Leu Glu Gly  
 130 135 140

Glu Arg Ala Val Leu Glu Ser Gly Ala Arg Ala Trp Val Val Arg Thr  
 145 150 155 160

Ala Trp Val Tyr Gly Ala Ser Gly Lys Asn Phe Leu Lys Thr Met Ile  
 165 170 175

Arg Leu Ser Gly Glu Arg Asp Thr Leu Ser Val Val Asp Asp Gln Ile  
180 185 190

Gly Ser Pro Thr Trp Ala Ala Asp Leu Ala Ser Gly Leu Leu Glu Leu  
195 200 205

Ala Glu Arg Val Ala Glu Arg Arg Gly Pro Glu Gln Lys Val Leu His  
210 215 220

Cys Thr Asn Ser Gly Gln Val Thr Trp Tyr Glu Phe Ala Arg Ala Ile  
225 230 235 240

Phe Ala Glu Phe Gly Leu Asp Glu Asn Arg Val His Pro Cys Thr Thr  
245 250 255

Ala Asp Phe Pro Leu Pro Ala His Arg Pro Ala Tyr Ser Val Leu Ser  
260 265 270

Asp Val Ala Trp Arg Glu Ala Gly Leu Thr Pro Met Arg Thr Trp Arg  
275 280 285

Glu Ala Leu Ala Ala Ala Phe Glu Lys Asp Gly Glu Thr Leu Arg Thr  
290 295 300

Arg  
305